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JOURNAL

OF

THE FRANKLIN INSTITUTE,

OF THE

State of Pennsylvania,

AND

AMERICAN REPERTORY

OF

MECHANICAL AND PHYSICAL SCIENCE,

CIVIL ENGINEERING, THE ARTS AND MANUFACTURES,

AND OF

AMERICAN AND OTHER PATENTED INVENTIONS.

EDITED

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JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA,

FOR THE

PROMOTION OF THE MECHANIC ARTS.

JULY, 1847.

CIVIL ENGINEERING.

Third Annual Report of the South Carolina Railroad Company.

Gentlemen,—The Board of Directors have the honor of presenting to the stockholders their third annual Report of the operations of the South Carolina Railroad Company, for the year ending the 31st of December, 1846.

The gross receipts for freight, passengers, and mail service, for the year 1845, were	$558,697·71
The expenditures for same period, embracing ordinary current expenses, additional machinery, improvements on depot, and interest on foreign and domestic debt, were - - -	389,148·10
	169,549·61
Amount of dividends paid,	147,900·00
Balance applied to improvement of property,	21,649·61

From the above, two semi-annual dividends of $2·25 and $2, making $4·25 on each share was declared, being within a fraction of 5¾ per cent. on the par value, 75 dollars, of the road stock, and leaving, as shewn, $21,649·61 applicable to the objects as stated.

The gross receipts from all sources for the year 1846, were,	$ 589,081·25
The expenditures for same period, including current expenses, additional machinery, improvements on depot, interest account, paving Meeting street, and damages, were	418,171·17
	170,910·35
Amount of dividends paid,	140,725·50
Balance applied to improvements of property and reduction of indebtedness,	$ 30,184·85.

The two semi-annual dividends were, for the first half year, $1·50, and the last $2·50, making $4 on each share, and equivalent to 5⅓ per cent. on par value of stock, and leaving, as exhibited, $30,184·85 applicable to improvements. The large amount under the general head of expenditures for the year 1846, as compared with those of the previous years of 1844 and 1845, may be explained by an appropriation for the improvement of Meeting street, and for damages: particularly in the loss, from fire, (supposed to be the act of an incendiary,) of a large amount of cotton, while in the cars on the track at Aiken, ready for departure by the downward train the next morning. If these amounts (as in the Auditor's comparative statement of ordinary expenses, since the consolidation of the two companies,) be deducted, we have for the legitimate and unavoidable expenditures, under all the various heads of current, materials, property and interest account, $282,972·31 in the year 1844, $279,475·43 for 1845, and $300,672·22 for 1846—shewing, as compared with 1844, an excess of expenditure of $17,699·91, against an increased receipt of $56,210·57; and, as compared with the last or previous year, an excess of $21,196·79 of expenditure against $30,383·81 of increased receipts. A considerable portion of this excess of expenditures may be accounted for in the enhanced cost of supplies; in the large amount of materials on hand; (as exhibited in the schedule from the master of the workshops;) in preparation for the construction of an additional number of cars; and in the increased expense necessary to preserve the track of the Hamburg road from the injuries inflicted by the heavy locomotives, and the higher speed of the passenger trains. The relative proportion likewise between the receipts and expenditures this year, were greatly disturbed by the low rate (with a view of relieving the suffering planters of the interior) at which the Company undertook to transport grains.

Upwards of 250,000 bushels of corn alone, the last season, were transported to Columbia, Hamburg, and intermediate stations; and at the moderate rate of freight charged, *a portion of it free*, it is apparent that much the largest moiety of the amount was made chargeable in the columns of expenses, while a very small balance was carried to the credit side of receipts. The receipts of the first half year of 1846, which were greatly affected by the reduced crop of 1845, had likewise an influence in disturbing the relative proportions between receipts and expenditures, for, by reference to the Auditor's accounts, it will be seen that of the amount, $589,081·52, received for the year 1846, but $251,741·36 were taken in the first half year, while the last half year, the receipts were swollen to $337,340·16; and under such a pressure on our locomotives, cars, and available force, as unavoidably to involve greater expense from the necessity of loading cars and running the trains at night.

The report of the Auditor, with the accompanying tabular statements, numbered from 1 to 7, exhibits, in a clear view, the state and condition of the property and finances of the Company, with its liabilities, assets, &c., for the year 1846; and of the monies received and expended on account of the stock, and on the construction of the Camden Branch Road. The tabular statements, Nos. 4, 5, and 7, exhibit the number of passengers conveyed on the road, the amount of freight, separating that which goes into, from that which comes from the interior, the number of bales of cotton received at each station, the number of packages and pieces of merchandize forwarded by railroad into the interior, and the amount of articles received by railroad for transmission to other places, with a comparative statement, in table No. 7, of the income of the road for the last three years, (commencing with the consolidation,) from all sources, exhibiting the average number of locomotives in active service, their arrivals and departures, with the number of miles run. Appended to these documents, is a statement for the last three months of the year, commencing with the more recent extension of the lines of railroads to the west; from our agent in Hamburg, of the number of packages of merchandize, with the value of the freight thereon, forwarded to the different stations beyond Atlanta in Georgia, where the trade with North Alabama, the Coosa District, and Eastern Tennessee may be said to commence, with an exhibit of the returns of the same in cottons, grains, western productions, and domestics. From these beginnings of a trade just emerging from the western horizon, the extent of which in the future cannot be estimated, and must greatly exceed even the speculations of the most sanguine—the stockholders will be the better judge of the facilities, which it is for the interest of this Company to continue to afford. In connecting the forwarding with the other obligations of common carriers, your direction have been influenced, not merely by the example and practice of other companies competing for the same business, but with a view of so cheapening and of so perfecting the means of transportation as to bring not only contiguous points, but even those the most remote, in certain and intimate communication with each other, thus augmenting the transportation on the road as the ranges and circles of commercial intercourse were extended, diverting to, and through Charleston, merchandize and produce which hitherto sought the markets of consumption by other channels; and into which they would still continue to flow, if equal and greater facilities were not afforded by what is now known and designated as the Carolina and Georgia route to the West. The policy pursued has not been without its favorable results on the transactions on the road. As this matter, however, was referred to a committee to report on, your Board do not consider any further remarks necessary beyond the presenting on this occasion, statements and facts for the determination of the maturer judgment of the stockholders.

The report of the Superintendent of the road, Mr. Lithgoe, is not as favorable as your direction could have desired. His statements, which have been confirmed by the inspections of the President, are: That the track, from the very light iron rail in use on the Hamburg portion of the road, is beginning to suffer from the heavy freight trains and locomotives which the increased business has now rendered indispensable. The greater number of passengers in the daily trains, and the higher speed exacted under contract for mail service, and to meet the competition of other traveled routes, have likewise conspired to produce similar injurious effects. The iron rail is wearing daily, and in some instances has become so thin, (though of the flanch form,) as to be very little superior to the common flat bar, which the South Carolina Canal and Railroad Company found necessary, at a former period, to remove. This subject, in part, was brought to the notice of the stockholders in the last annual report, and the recommendation of importing a certain amount of new rails annually, to be substituted for those which were impaired, met with your concurrence; —subsequent experience, however, affording more time for examination, and which accords with that of other railroad companies in Europe and the United States, who, in the first instance, used rails of a moderate weight on their tracks, with the views communicated by Mr. Lithgoe, (under whose daily inspection is brought the effects of heavy weights in rapid motion on a light superstructure,) would favor the policy of preparing, at an early date, for the gradual substitution of five or ten miles annually of a heavier—for the flanch rail now in use, to the extent, at least, of the main trunk of road from Branchville. This trunk, 62 miles in extent, now sustains the business of both the branches to Columbia and Hamburg, and will soon have added that of the Camden and other roads now projected, with the view of a connexion with the South Carolina. Promptness of execution, certainty, and security are the strong recommendations of railways, and if they are not so constructed as to ensure these requirements by the public, the transportation on them will diminish, or be executed without satisfaction, with frequent interruptions, and at great hazard. The stockholders of the Baltimore and Ohio Company, the road of which was constructed, on the lower section from Harper's Ferry, with a light flat bar, have commenced the substitution of an iron rail of a heavier and more serviceable weight; and the able report of its Engineer, accompánied with valuable statements and calculations of the injury inflicted on iron rails, according to the velocity and amount of tonnage transported periodically over them, demonstrates *that in the greater annual expense of maintaining a track with a light rail, the Company, in the course of time, will be amply remunerated for the larger capital, which, in the first instance, a rail of heavier weight will involve.* The experience on that road, which, in all its operations, is more assimilated to those of the South

Carolina than any more to the north of it, but made more apparent from the heavier amount of tonnage transported than the South Carolina has as yet attained, has been amply confirmed by the report of Mr. Lithgoe. While the maintenance of way on the Columbia Road, constructed on cross-ties, and with a T rail of 57 pounds to the yard, (though the timber of a considerable portion of the lower section had to be removed,) does not exceed 160 dollars to the mile—that on the Hamburg Road has amounted to 351 dollars—and even at this cost the superstructure, in many places, has with great difficulty been preserved in the condition that the interests of the Company prescribes. "The present iron," says the Superintendent, "imbeds itself in the timber, so much so, that the timber has to be removed more from this cause than from decay. I am of the decided opinion that the timber in which the iron lays, on an average, will not last longer than three years. If this be the result, is it not a matter for consideration whether it would not be better at once to adopt a heavier iron?" While on this subject of defect in the road, and of the remedy necessary, is brought to the attention of the stockholders, it is with some satisfaction that the Board have to charge the injury sustained and complained of to an increased and continually increasing business, which, in requiring a superstructure equal in strength to the tonnage daily exerting its weight and power on it, furnishes, in the increased profits of transportation, the adequate means to renew the road, in sections, gradually as proposed.

The enhanced expense in the maintenance of way, of a superstructure too light and too fragile for the weight and velocity of the machines it has to resist, forms but a small portion of the injuries otherwise sustained, in all the varied operations of the road. If the track is weak and defective, and subjected to repeated dislocations, accidents accumulate; delays in the arrival of trains, involving loss of time, become more frequent; damages and forfeitures are oftener incurred; and the injury to machinery in locomotives of a delicate texture and easily deranged becomes incalculable. In a heavy superstructure, therefore, and a firm, unyielding road-bed, is reliance alone to be had for a perfect railway; adapted to any emergency, and equal to any power or velocity which it may be desirable to apply on it. This subject, therefore, is submitted to the serious consideration of the stockholders, that they may either, by a committee reared for this special purpose, examine into, and devise the means necessary to remedy the approaching difficulties, in the defect of road anticipated, or devolve on our successors in office ample power to act in the premises as the interests of the Company may recommend. The procuring the labor necessary and required on the different sections of road, by hiring at fair rates, is another difficulty presenting itself. "After hands," says the Superintendent, "for many years in the Company's service, have acquired the knowledge and skill necessary to make them valuable, the Company are either compelled to submit to higher rates of wages imposed, or to pass others, at a lower rate of compensation, through the same apprenticeship, with all the hazards of another strike, in their turn, by the owners." This difficulty involves the advantages of the policy of owning by purchase, the labor necessary for service on the road, or to continue to be exposed to all the hazards of hiring under the present system, and the chances of being raised upon in times of emergency. Mr. Lithgoe reports that ten women and seventy-five young men may be advantageously and profitably employed in the place of many of those now hired; the wages paid for whom would be a high remuneration to the Company for the capital so invested. All of which views are respectfully submitted to the consideration of the stockholders.

The report of the master of the workshops, and of the agent of transportation, exhibits the state and condition of the property in machinery, the number of cars on hand, the number of locomotives in service and their present value, the number of those disabled but susceptible of repair, and the number which, from age and hard usage, are unfit for renewal, though portions of their parts may be worked up in other machinery—and the additional number of both cars and locomotives which will be necessary to meet the pressing demands of a constantly increasing business to the satisfaction of the community to be accommodated. This report is very satisfactory as to the service which has been rendered the last year by the Company's locomotives, the number of miles performed, and the proportional number of engines, compared with the entire number owned by the Company, which have been kept in repair and on active duty. It is believed that the performance, for the last six months of the year, with this limited power, will bear a favorable comparison with the like number and class of locomotives on any other road. With this report is a statement of the work performed at the smith shop, foundry, and car factory. These statements go far to recommend the policy of a large addition to both the Company's car and locomotive power. It is true economy never to press too severely upon machinery so easily deranged as that on a locomotive, and always to be so amply supplied. No locomotive, after performing a trip exceeding 260 miles in extent, should resume her position on the track before a thorough examination, and reported in a proper condition, by the master of the workshops. The exigencies of the business of the road, compelling the extra service of a locomotive, when disabled, or not in a proper condition, is always performed at a cost detrimental to the best interests of the Company. In England, and on all economically managed railroads, it is considered advantageous to own double the number of locomotives which the actual business of the road may require, so as to afford time for examination and reparation of all on their return trips, and to be prepared with extras for every emergency, without resorting to unprofitable expedients to meet the unexpected demands of the trade, or of a community for accommodation. *Semper Parati*, is the true motto for the guidance of all railroads, and, in accordance with its admonitions, your present directors have made arrangements for such an increase of motive power, passenger and burden cars, for the ensuing year, as will, in their judgment, meet the requirements of the road; and, with the experience which has been their guide in this case, they recommend the execution to those who may succeed them in office.

The report of the engineer, Mr. McRae, of the Camden Branch, shews the present condition and progress of that work, notwithstanding a suspension of operations the last spring for nearly two months, with a hope that the citizens of Sumter might be accommodated by a change of route in the road proposed; and the subsequent summer and winter interpositions of successive floods in the Wateree river, the work has been steadily progressing, and a hope is still encouraged that, with the powerful aid of steam, and energetic contractors, the passage of the Wateree river and swamp may yet be accomplished in time to enable the Company to press forward, with all practicable despatch, during the summer and fall months, with the superstructure to Camden. A large portion of the grading along the entire line is already completed; the whole is under contract; the wooden superstructure with the rails, between the Congaree and Wateree, are now in progress. Iron, sufficient for the completion of that section has arrived, and if the floods of the Wateree do not interpose any further obstacles than those which have already been encountered, the engineers feel confident that all the objects, as to time, in completing the road, will yet be realized. But the best devised plans, and the most powerful of human efforts have, at times, to yield to elements which are not to be controlled, and often too powerful successfully to resist.

Your Board of Directors, with much satisfaction, congratulate the stockholders on the beneficial results of that liberal policy early adopted on their part, of extending countenance and credit to all sister roads, having for common objects the bringing the western portions of our Union in more intimate social and commercial relations with those of the south. The roads in Georgia and Alabama are rapidly and successfully progressing—many of them finished—new roads, penetrating more remote, and hitherto inaccessible sections in those and the adjacent States of Mississippi and Tennessee, projected; and companies in progress of organization for immediate and successful action. The road from Chatanooga to Nashville is no longer a problem, and we have every assurance of the most energetic efforts to commence and push it rapidly to completion. The Hiwasse railroad, opening a communication to Knoxville and the interior of eastern Tennessee, has been revived, and will receive a new impulse on the completion of the Western and Atlantic to Cross Plains, now only awaiting the daily expected arrival of the iron to finish it. The interior of Alabama is looking with deep interest to a railroad communication between the Georgia and Tuscaloosa, by the Rome branch and Valley of the Coosa. Superadded to these, charters have been granted by both of the legislatures of North and South Carolina, and our people are everywhere awakening to the importance of rendering more intimate and binding, by railroads, the city of Charleston with the interior districts of our own and more northern sister.

The most gratifying symptom, however, in all these movements, is the enlightened spirit by which the projectors seem now to be influenced—repudiating all idea of monopoly, rivalry, and competition. We have witnessed with gratification, in a recent convention at Macon, indications of a desire for that concert and union, in all these enterprizes, by which our Southern railroads are to be considered not exclusively State works, but as a part of a common system; the veins and arteries of a great commercial body, animating in the reciprocal circulations of its trade, the whole, and paralyzing, by impediments, or restrictions, no portion. We cordially respond to views so enlightened, and so well calculated, at this time, to stimulate and bring in closer communion interests having the common object of prosperity to all.

Respectfully submitted,

JAMES GADSDEN, *President.*

Charleston, S. C., Feb. 9, 1847.

Statement of the number of Passengers conveyed upon the Railroad between Charleston, Hamburg, and Columbia, with the amount received for Freight and Passage, from 1*st January to* 31*st December*, 1846.

	PASSAGE.						FREIGHT.			
	Up.		Down.		Up and Down.		Up.	Down.	Up & Down.	Total Am'nt.
	No. Pass.	Amount Passage.	No. Pass.	Amount Passage.	No. Pass.	Amount Passage.	Amount Freight.	Amount Freight.	Amount Freight.	Freight and Passage.
January,	2,337	7,467·76	2,012	6,391·27	4 349	13.859 03	9,389·49	9,486·65	18,876·14	32 735·17
February,	2,022	7,144·36	1,684	6,159·43	3,706	13,303·79	10,557·28	9,168·01	19 725·29	33,029·08
March,	2,576	9,083·62	2,008	7,226·18	4,584	16,309·80	20 415·93	10,192·33	30 608·26	46 918·06
April,	8,014	10,377·42	7,753	8,786·36	15,667	19,153·78	18,204·41	8,469·68	26,674·09	45,827·87
May,	2,624	8,560 47	1,973	6,359·36	4,597	14,919·83	12,908·49	9,110·01	22,018·50	36,938·33
June,	2 182	6,483·82	1,673	4,979 05	3 855	11,462·87	7,241·91	5,531·38	12 773·29	24 236·16
July,	1,866	5,341·23	1,555	4,752·85	3 421	20,094·08	7,116·38	7,166·75	14,283·13	24,377·21
August,	1,764	5,915·11	1,505	4,232·23	3,269	9,147·34	9,520·29	5,704·57	15 224·86	24.372·20
September,	2,203	7,582·69	1,421	4,205·77	3,624	11.788·46	20,916·28	10,647 32	31.563·60	43,352·06
October,	2,693	9,491·88	2.399	8,192·77	5,092	17,684·65	26,948·31	33,951·15	60.899·46	78,584·11
November,	2,748	9,806·80	2,285	8,605·24	5,033	18,412·04	16 072·77	39,796·14	55.868·91	74,280·95
December,	3,152	10,093·38	3,687	11 215·15	6,839	21,308·53	12,999·42	30,174·97	43,174·39	64,482·92
Total,	34,181	96,348·54	29,955	81,095 66	64,136	177,444·20	172,290·96	179,398·96	351,689·92	529.134·12

Received for freight and passage as above, . . .	$ 529,134·12
" " through tickets sold by Georgia Railroad Co., the past year	12,200·67
Total freight and passage, .	541 334·79
" " transportation of the mails for the past year, . .	39 746·76
" " rents, storage, and other minor sources, . .	7,999·97
Total receipts for the year, .	$ 589,081·52

THOMAS WARING, *Auditor.*

Statement of the number of Bales of Cotton received in Charleston, by the Railroad, from Jan. 1 to Dec. 31, 1846.

	Hamburg	Aiken.	Bl'kville.	Midway	Br'chville	Way H. R.	Tot. H.R.	Columbia	Gadsden.	Lewisville.	Orangeb'rg	Way C. B.	Total C. B.	G Tota .
January,	4,314	77	281	282	13	197	5,164	3,271	950	226	149	404	5,000	10,164
February,	4,478	31	510	212	21	83	5,395	3 829	282	220	101	860	5 292	10,687
March,	5,202	11	177	58	63	47	5.558	5,399	339	147	80	68	6,033	11 591
April,	3,106	34	345	185	23	161	3,854	3,820	90	662	205	219	4,996	8 850
May,	6 849	15	53	91	78	46	7,132	4,034	371	275	65	131	4,876	12,003
June,	3,650	00	1	44	00	00	3,695	2,636	154	40	00	108	2,938	6,633
July,	6,365	33	54	00	17	5	6,474	2,205	9	145	00	258	2,617	9 091
August,	4,649	00	3	2	00	8	4,662	1,537	36	00	00	12	1,585	6,247
September,	7,229	00	15	8	56	7	7,315	3,772	190	00	00	138	4,100	11.415
October,	14,117	50	348	227	91	135	14,968	14,902	1,241	564	174	1,023	17,904	32 872
November,	18,901	88	688	332	95	920	21.024	15,112	963	731	237	476	17 519	38,543
December,	15 998	7	414	208	100	135	16,892	9,641	386	319	79	853	11,278	28,170
Total,	94,858	346	2,949	1,679	557	1,714	102,133	70,158	5,011	3,329	1,090	4,550	84,138	186,271

Statement of the number of Packages and Pieces forwarded on the railroad, (up.) from 1st January to 31st December, 1846.

In January,	2,776	Pieces and Packages	from	29	Vessels.
February,	2 536	do.	do.	24	do.
March,	5,778	do.	do.	30	do.
April,	3,828	do.	do.	25	do.
May,	2,646	do.	do.	34	do.
June,	1 827	do.	do.	34	do.
July,	885	do.	do.	22	do.
August,	3,113	do.	do.	27	do.
September,	8,617	do.	do.	28	do.
October,	17,748	do.	do.	55	do.
November,	6.352	do.	do.	31	do.
December,	4,787	do.	do.	41	do.
	60 893	do.	do.	380	do.

Statement of articles received by the railroad and forwarded to other places, in the year ending 31st December, 1846.

6,822 bales Cotton,
31 " Waste,
619 " Yarn,
35 " Domestics,
6 " Wool,
4 " Fur skins,
3 " Rags,
22 " Pink-root, Ginseng, &c.,
1,353 bags Feathers, Roots, and Wax,

22 bags Dried Peaches,
34 bbls. Wax and Mdze.,
1 tierce Wax,
6 casks Wax & Mdze.,
114 boxes Mdze.,
7 " Indigo
24 packages Mdze.,
10 pairs Bellows,
7 Trunks.

Total, 9,120 pieces and packages.

THOMAS WARING, *Auditor.*

General Statement of Receipts and Expenditures for the year 1846.

Gross receipts from all sources in first half year,		$251,741·36	
Ordinary current expenses for same time,		193,592·21	
Nett profit for the first half year,		58,149·15	
Gross receipts from all sources for the second half year,	$337,340·16		
Ordinary current expenses for same time,	224,578·96		
Nett profit for second half year		$112,761·20	
Nett profit for the year 1846,			$170,910·35
From the nett profit two dividends have been declared, making the average per cent. on the joint dividend 5⅓ pr ct. on par value,			140,725·50
Leaving a nett balance, accounted for as follows, of			$30,184·85
Reduction of balance of indebtedness in the year,		$5,946·15	
Reduction of amount to debit of improvement of depots and property, including one locomotive, and charged to income account in last six months,	$11,332·78		
Paid for improvement of depots and of property, including one locomotive, in first six months,	9,634·49		
		20,967·27	
Paid for lands,		2,961·43	
Paid on account construction of Columbia Branch,		310·00	
			30,184·85

Gross receipts from all sources for the year,	589,081·52
Paid ordinary current expenses for the year,	418,171·17
Nett profit for the year,	170,910·35
Deduct two dividends,	140,725·50
Leaves a balance, accounted for as above, of	$30,184·85

Interest on sterling bonds for the year, and included in the above amount of ordinary expenses, ($418,171·17,) $108,530·05

THOMAS WARING, *Auditor.*

The Helder, or Great North Holland Canal.

At a meeting of the Institution of Civil Engineers, Feb. 28, a supplement to the papers on "the Helder or Great North Holland Canal," by Mr. G. B. W. Jackson, was read. It contained a description of the harbor and works at Nieuwediep, which might be considered as legitimately connected with the Helder canal, inasmuch as they were constructed with a view of affording shelter to vessels of war and merchantmen navigating the North sea. The banks, or shoals, situated at the mouth of the Marsdiep channel, act in a peculiar manner; they narrow the entrance, resist the undue influx of the tides, thus preventing injury to the coast of the Zuyderzee; they oppose difficulties to the entrance of hostile fleets, as the navigable channels run within range of the protecting forts; and they assist in maintaining the velocity of the currents which keep the channels at their usual depth. On the coast of Holland, the ebb-tide continues to pass off along the Noorder-gat a full hour and a half after the tide has commenced flowing up along the Schulpen-gat; this can only be accounted for by supposing that the tide runs up from the south-west, and enters the Schulpen-gat, whilst the ebb still continues, in consequence of the draft of the tide northward along the coast. The Schulpen-gat and the Landsdiep may, therefore, be termed the flood-channels; whilst the Noorder-gat may be considered the ebb-channel. Upon these spots, whose preservation was of such consequence to the country, the Dutch have lavished their best care, and exercised their ingenuity.

The shore-works consisted chiefly of groynes, composed of timber piles and fascines, with stone covering. The average length was two hundred yards, with slopes of about one in eight or ten. In consequence of the report of the commission appointed in 1780, the engineers, Brunnings and Goudrai, were instructed to proceed with the formation of a warping bank of fascines, 7360 feet long, with double planking guard to accumulate the sand, in order to fill up the interstices of the fascines, and thus preserve them from decay. A breakwater, also, 1850 feet in length, 73 feet wide, at three feet below high water, with slopes of one to one. This was also formed of fascine beds, weighted with 2000 lbs. of stone, and 4000 lbs. of tiles upon every superficial area of 144 square feet. The upper surface was covered with matting, and made convex, the centre being one foot, and the sides three feet, below the level of high water. Hurdling was then used, and the whole was covered with blocks of stone weighing from 1500 lbs. to 1800 lbs. each. An additional length of 2080 feet was subsequently built, the warping bank being completed, and by means of these works, the ebb-stream was increased to such an extent as at once to deepen the channel eighteen inches, although the bed was of clay. In 1783, dredging was resorted to, and, with the action of the stream, a depth of nineteen feet was arrived at. The whole length of the proposed harbor was then dredged to a depth of seventeen feet under high water level. Another warping bank of 3675 feet in length was then constructed, with numerous groynes to arrest the sand, and preserve the coast. A quay-wall and jetty were then added; the piles composing the latter were covered with sheet-lead between high water level and one foot below the ground, in order to preserve them from the ravages of the *Teredo Navalis*, which, however, it is the popular opinion, may be also prevented, by driving the piles through fascines. A portion, sixty feet in length, of the breakwater was torn away by a storm; this slip was filled up with large stones, but they were ineffectual, and fascines were ultimately had recourse to for repairing the breach. The depth of the channel was thus increased to nearly thirty-five feet, so that frigates could pass with safety. In 1789, one hundred and fifty-one vessels were lying there at anchor, fourteen of which were men of war, and four were East Indiamen. The basin is 1292 feet long, and 646 feet wide, with large storehouses, dock buildings, fortifications, &c., of the most solid description, and thoroughly complete for a naval arsenal. The details of every part of the works were given. A special vote of thanks was passed to Mr. Jackson for the paper.

Remarks.—An interesting discussion ensued, in which the highest compliments were paid to the author for the paper he had presented, and the manner in which it was illustrated. A description was given of Dymchurch wall which defends Romney Marsh, an extent of 24,000 acres, and also of several other sea-defences at the mouth of the Thames, and elsewhere, in which fascines were extensively used. The Nene embankments were also described. Specimens were shown of the *Arundo Arenaria*, a coarse grass, whose roots extend sometimes to a length of upwards of thirty feet, and which is eminently useful in securing the sand of the coast from being blown or washed away.

Among several cases of the failure of protecting-walls, one was particularly described of a nearly vertical sea-wall, whose foundations were sunk down full five feet below the shingle of the coast: the wall was built with great care, and with first-rate materials—it was, however, exposed to the action of a heavy sea in North Wales. During a severe storm, the waves were thrown up in a mass full forty feet above the wall, and falling from that height, with the force due to such a distance and mass, very speedily destroyed the whole wall. In quite as exposed a situation, a slope, which enabled the waves to expend their strength, and broke them up into foam, did not suffer at all. Numerous deductions were drawn from these and many other instances, all unfavorable to the theory of vertical sea-walls, which it has recently become fashionable to recommend as a theoretically even more correct form, in opposition to the well tried plan of eminent civil engineers, who have almost universally adopted slopes for resisting the action of the sea.

March 2.—This evening the discussion upon Mr. Jackson's paper was renewed.

The comparative advantages and disadvantages of vertical and sloping sea-walls were discussed, and instances were given of the effect of seas upon the former when walls of a certain batter or curved face, surmounted by an overhanging coping of such an extent as to deflect the curling wave outwards, and throw it back upon itself rather than allow it to fall bodily inwards, as in the case of the Penmaenmawr wall mentioned at the last meeting. The manner in which the waves were driven up long slopes, acquiring force as they traveled along, was contrasted with this. On the other hand, the action of the various kinds of waves was shown upon sections of the beach at Madras, where the surface was so notoriously bad, and where it appeared that by the clawing off of the waves the beach was washed away into natural steps, of a level and then a small slope of 45°. A breakwater had been formed off that beach, by throwing in loose masses of rock forming their own slope; this, when carried up to within ten feet of the water-level, stood well.

In Nootka Sound, the same effect of the drawback of the waves was noticed. Sections of the Mole of Venice were shown. That mole, which is nearly 16 miles in extent, had a section of a sloped foreshore with a nearly vertical wall, then a slope at another angle, and above high water mark another nearly vertical wall. When the seas rolled in upon the mole, they partially curled over against the first wall, and were projected with augmented force against the upper one. The consequence was, that the mole was partially destroyed, and in the repairs, which had been executing for some time, it had been reduced to one uniform sloped face, at an angle of about 15°. The destruction of the nearly vertical walls of Portpatrick was also noticed. Those walls, although constructed of the finest Anglesea limestone, well dressed, dove-tailed, and tied down vertically and horizontally by iron chain-bonds, were completely overthrown; and, until the thickness of the wall was increased to 80 feet of solid material, it could not be made to stand. The situation was extremely exposed, and the sea frequently sprung 50 feet above the top of the light-house, which was itself 60 feet above the level of high water of spring tides. The causes of the peculiar action of the draw-back of the waves, as exemplified by the removed shingle from the beach when the wind was on shore, and its accumulation when the wind blew off the shore, were also discussed; and it appeared to be the received opinion that, in these cases, the upper part of the waves being acted upon by the wind, a peculiar rolling motion in a counter direction was imparted to the lower wave, which acted upon the shingle in the manner alluded to. This action appeared, however, only to extend to a depth of about nine feet, which, it seemed to be agreed, was the ultimate depth of detrimental action of all waves. The forts of Boulogne were given as further examples of the reflection of waves from nearly vertical walls; but it was shown that the darting over of the waves there, was caused by their falling within the re-entrant angles of the fortification.

The effect of advanced groynes in protecting sea-walls was exemplified by the concrete walls at Brighton and Dover, which were extended merely for retaining walls; and such was the effect of the groynes, that, since they had been put down, the shingle had accumulated to such an extent, that the sea did not approach injuriously to within 100 feet of the base. Our limits will not permit a greater detail of this interesting discussion, which will, however, appear entire in the proceedings of the Institution. Civ. Eng. & Arch. Jour.

On the practical forms of Engineering Works exposed to the action of the Waves of the Sea, and on the advantages and disadvantages of certain forms of construction for Breakwaters and Sea Walls. By Mr. JOHN SCOTT RUSSELL.

[Read at the Institute of Civil Engineers, March 9th, 1847.]

Although agreeing, as a general proposition, with the truth of the observation, that it was impossible to lay down any one undeviating rule for a form of sea wall which should suit all cases,—the author had, from long and careful experiment, and examination of various localities, endeavored to classify certain forms of artificial constructions, and to adapt them to certain cases, having reference in each case to the action of the waves to which they were to be exposed. His first process was to examine the action and character of the several kinds of waves, deducing, as a given axiom, that,—First, The common form of waves is cycloidal. Second, The motion of the waves in a disturbed state is circular, and in a vertical plane. Third, The water near the top of a wave moves the same way as the wave itself. Fourth, The water in the hollow between the waves is receding. Fifth, The power of a wave is exactly in proportion to the height of its crest above the hollow between the waves. Sixth, The greatest power a wave can exert is at the moment of the crest breaking over into the hollow. Seventh, Waves in the British seas have rarely been seen of a greater height than 27 feet above the hollow, and 32 feet may be taken as their greatest unbroken height; those of the Atlantic being stated to range higher. Eighth, Waves have never been seen of the full depth of the water forming them, hence it is deduced that the greatest force waves can be exposed to, may be determined by the depth of the water they are placed in. Ninth, There are two or more classes of waves,—wind-waves, short, high, and superficial; and storm-waves, which are long, low, and deep. Tenth, The depth of agitation caused by a wave is in the ratio of its height and length conjointly. Reasoning upon these data, the paper then proceeds to examine two classes of hydraulic works. First, Those which are designed to act upon the waves; and, Second, Those whose structures are exposed to the sea without any design of controlling it, but only to guide it under particular circumstances.

Of the first class are sea walls, piers, and other sea defences intended to restrain the action of the waves; for the forms of which a number of designs were given, ranging between the flat slope, with a foreshore, and the vertical wall. Of all these, the preference was given to a wall having a concave or cycloidal curved face, to carry the wave up without breaking; overhanging coping curved on the underside to return the wave upon itself, and a recessed parapet on the outside to prevent the wave from being thrown inside. For breakwaters, whose object was to resist the waves and produce still water within side, the best mode, under all circumstances of locality, variety of materials, and cost, appeared to be the depositing of the large and small materials, and allowing them to find their natural slope under the action of the waves.

Of the second class, are works designed to direct the scour at low water, but which are quite covered at high water, the foundations of light-houses, &c., the object being to oppose the least possible resistance to the waves, and to suffer the least from them. Groynes, embankments, and other works intended to be under high water, also coming under this class; the best form is the parabola, with the foot curved outwards on each side—the apex being raised or lowered, and the base proportioned to its application. This form being extended upward, approximates to that of the Eddystone, Bell-rock, and Skerryvore light-houses, which have withstood the action of heavy seas so successfully.

The vertical wall was condemned for many satisfactory reasons:

the cost of workmanship, the expensive character of the materials, the liability to destruction if a breach be made, and the unsatisfactory action, in consequence of the waves making a clear breach over them in heavy weather.

In the discussion that ensued, many interesting illustrations were given of the truth of these positions, derived from the works of Whitehaven, those on the South Devon Coast, and those at Hartlepool, in which latter case the strong red marl, dry punned, and mingled with small stone, and faced with pitching, had been satisfactorily employed, at a very small cost, for the construction of piers. Ibid.

The Isthmus of Tehuantepec.

Extract of a letter from the Vice President of the United States, addressed to a gentleman of the city of Philadelphia, and published in the "Spirit of the Times" of that city.

To abridge the tedious and dangerous voyage around Cape Horn, and to give to navigation a direct and safe access to the eastern shores of the Pacific, has been a favorite scheme for centuries of scientific exploration and of mercantile hope. For a long time its practicability at any point was disputed. The best inquiries left it in doubt. Every narrow portion of the continent of America has undergone examination; has, for a while, been regarded with preference, and has again been abandoned. Difficulties sprang up as to each, and a comparison of their relative advantages, affected more or less by the desire of the respective engineers and explorers to render the junction of the two seas specially serviceable to their own countries, excited apprehensions as to all. Still I am abundantly satisfied that the project is not only practicable, but practicable under the joint auspices of the United States and Mexico, at a moderate cost, and within a short time.

Five routes for crossing have attracted special notice. 1. By the isthmus of Panama. 2. By the isthmus of Darien. 3. By the lake of Nicaragua. 4. By the river Atrato, from the gulf of Darien, running south through Choco, in New Grenada, until it nearly meets the San Juan, which empties itself into the Pacific at the port of Charambiro. And 5. By the isthmus of Tehuantepec. Of these routes it may in general be said that the one across the isthmus of Panama and the one by the lake of Nicaragua have been heretofore best explored and most approved. In 1805, Baron Humboldt, who enumerated four additional routes, was discouraged as to that by Panama, because "*no measure of elevation, and no level, had ever yet been executed in that isthmus;*" and from all the information he could procure, it appeared to him that the expectation of a ship channel by canal across that isthmus "*ought to be completely abandoned.*" Since that period, however, the topography of the region has been carefully and closely investigated. Steam power and railways have become adjunctive elements for calculation and arrangement, and conclusions much more favorable, as well as better founded, may now be drawn. In 1825, a well-reasoned but still imperfect judgment in favor of the Panama route was published, and several others have since appeared; but the last, and far the most impressive, is in a Parisian pamphlet purporting to be an abstract of a report made to M. Guizot, the Minister of Foreign Affairs, by Napoleon Garreli, engineer in chief, attached to the Royal Mining Corps in 1845, and to set out a "Project for uniting the Atlantic and Pacific Oceans by a Canal across the Isthmus of Panama." In 1829, G. A. Thompson, a diplomatic agent of the British Government, published his "Official Visit to Guatemala;" and he therein describes the route by the lake of Nicaragua, and the various steps which had been taken (in 1825) as well by the king of the Netherlands as by great banking houses in England, with the legislative sanction and aid of the local government, to form a navigable communication between the two oceans by means of that lake and the river San Juan. This mode of effecting the object has commended itself, after critical scrutiny, to many others, and seems to be somewhat favored by P. Campbell Scarlett, a British traveler, in his lively work on "South America andthe Pacific," printed in 1838.

You cannot, however, be benefited by my considering further or minutely the facilities or difficulties of the Panama and Nicaragua routes. Whatever may be the superiority of their advantages, we are not in such a relation to them as can make it of the slightest practical use to enter elaborately into their development. Let me fix your attention exclusively on the route by the isthmus of Tehuantepec—a route which, if practicable on almost any terms, must recommend itself over all others, by being, as it were, at the very outlets of our estuaries, or on our commercial threshold.

This route runs through Mexican territory. It commences at the mouth of a river called the Huasacualco, emptying itself into the southern section of the Gulf of Mexico: it thence takes a generally southern and western direction until it reaches Tarifa, at which town a canal or rail-road begins; and the route with it continues in the same course to western lakes, which then furnish a direct highway to the river, the city, and the gulf of Tehuantepec on the Pacific. The topography of this isthmus has been investigated with some care; it might, indeed, be unwise to begin practical operations without a fresh and thorough survey, but enough is known to render it quite certain that the communication can be opened without unreasonable expenditure of labor or money.

The width of the isthmus, from the mouth of the Huasacualco on the Mexican gulf to the shores of the Pacific at Tehuantepec, is about one hundred and thirty-five miles. The central mountainous chain, which, conformably to its relative position throughout both Americas, is much nearer to the Pacific than to the Atlantic ocean, exhibits here a depression which continues from Santa Maria Patapa to Miguel de Chimalapa. For a distance of about twenty-five miles, a summit-level or plain is formed, whose streams flow north, and whose boundaries at the south and south-east are a chain of small hills called the Cerros (highlands) of Masalma and of Espinosa, which separate the waters flowing north from those flowing south, and between which, here and there, are passages, such as the Portillo (gate) of Chivola, and the Portillo of Tarifa. Streams, starting from this space of depression in the great mountainous ridge, and running *north*, empty themselves in the Huasacualco; those running *south* empty themselves in the Chicapa, which, in turn, discharges itself into the lakes east of Tehuantepec; and it is one or both of these rivers—Huasacualco and Chicapa—which may be employed in effecting the transit across the isthmus, by uniting them either by a canal, a railway, or a good macadamized road.

This route for the junction was pointed out by Fernando Cortez, the conqueror, as long ago as the year 1520. Indeed all the three principal routes to which we have referred—Panama, Nicaragua, and Tehuantepec—were designated by Lopez de Gomarra in his History of the Indies, as early as A. D. 1551; and it is worthy of remark, that these three routes are the only ones which, after the lapse of three centuries and many explorations, present the least promise for the construction of a ship canal.

For more than two centuries the hope of effecting a navigable communication between the oceans seems to have been wholly abandoned. At the close of the last century, however, this old project of uniting the Huasacualco with Tehuantepec, in Mexico, revived; and Augustin Cramer, after making some researches in 1774, under the orders of Viceroy Bucareli, proposed to carry it into effect by a canal, fed from two small tributaries of the Huasacualco. More recently, the general government of Mexico, in 1825, authorized General Orbegozo to explore this route; but that officer, misled by the defect of the only barometer he had with him, came to the conclusion that the construction of a canal there was a work almost impracticable, and restricted himself to recommending a good road. At last, in 1842, Joseph de Garay, having obtained, by legislative desire, the privilege of making a communication between the two oceans across this isthmus, established a board of commissioners under the direction of an engineer, Gayetano Moro, with instructions to give the isthmus a thorough scientific exploration. Moro published his labors and their results in 1844; and, as the information he gives is certainly the latest and most authentic, it may be agreeable to you to have it set forth briefly.

The village of Tarifa, which gives its name to the plain at the depression of the central chain of mountains to which we have referred, is seated about 700 feet above the level of the sea; the plain itself is somewhat lower. The hills which bound the plain on the south and southeast, and divide it from the waters flowing south, have but little elevation; and a cut of some fifty or a hundred yards in length would alone be sufficient to enable some of the streams on the plain to run south by the Portillo of Tarifa. One of these hills, the Del Convento, in which the Rio Monetza takes its rise, and thence flows into the Chicapa at San Miguel, stands alone, and on two of its sides, particularly at the north, are clefts so sunken that a cut through them would be a work of extreme ease. The direct distance between Tarifa and the river Bocabarra, through which the lakes on the western side of the isthmus reach the Pacific, is about thirty-seven miles. On the southern declivity, the principal streams are the Rio Ostuta and the Rio Chicapa, both of which empty themselves into the lakes, the latter about eighteen miles from the Bocabarra and nineteen miles from Tarifa. All the streams on the northern declivity flow into the Huasacualco, and that river, after a very winding course, reaches the Gulf of Mexico, about one hundred and five miles from Tarifa. One of its chief tributaries is the Malatengo, which flows into it on its left bank, about ninety direct miles from its mouth, or one hundred and sixty miles following its circuitous bed. The Chicapa, gauged above San Miguel Chimalapa, by combining several rivulets flowing from the central chain, rolls a body of water estimated at about twenty-two cubic feet per second. The Ostuta is in volume five or six times larger, and, which is really remarkable, and indicates extreme thirstiness of soil, this volume of water diminishes as it lengthens its distance from its original source.

The volume of water in the Huasacualco is great, and at the lower part of its course it would be navigable for ships of any size, were it not for the bar at its mouth. The depth of water upon this bar has been, at different times, ascertained to be: by Dampier, fourteen feet; by Cramer, eighteen feet; by Orbegozo, fourteen feet; by Robinson, twenty feet; by Moro, twenty feet. These differences are explainable, with great probability, by supposing the bar to be intersected by submarine canals, or clefts, and the soundings not to have been made in the same one.

At about thirty-three miles from its mouth, near a place called La Horqueta, (the Fork,) the Huasacualco divides into two branches, the right and chief of which, the Apotzongo, runs a course of twenty-five miles, and the other, or left one, the Mistan, a course of about thirty-three miles—they encircle a large island called Tecamichapa. Below this island, the depth of water always exceeds twenty-two feet, and becomes sometimes thirty-seven or thirty-eight feet. But above the re-union of the two branches, there are shallows, which, it is thought, may be got rid of by damming the Mistan at La Horqueta. Above this latter point, the depth decreases; at some places it is found to be from twenty-five to thirty feet, but in general it is less than twenty-one, and even sinks to seven or four. Two points only, however, may be regarded as difficult to overcome—the old Mal-paso, and the present Mal-paso—the first being between three and four miles below the confluence of the Malatengo with the Huasacualco, and the second between nine and ten miles below the first, at the confluence of the Rio Sarabria. At these two points, the rocky character of the river's bed would make its deepening difficult.

On the other side of the isthmus, the Bocabarra, which constitutes the pathway between the Pacific ocean and the lakes, or lagoons, into which flow the Chicapa and Ostuta, has a depth of about twenty-four feet; but its opening on the lakes is obstructed by a bar, whose depth of water does not exceed nine feet. Moro ascribes the original formation of this bar, in a great degree, to the fact that formerly the river Tehuantepec emptied itself into the lake, and is of opinion that if it were removed by artificial contrivances the result would be permanent. He thinks that this removal might be accomplished by giving a direction to much of the water of the Ostuta above towards feeding the canal, and thus diminishing the force of the current in the lake. After passing the bar the depth increases; but throughout the eighteen miles, or thereabouts, of distance from the bar to the mouth of the Chicapa, not more than nineteen feet of water are to be had, though modes of augmenting its depth could readily be found.

These minute details, translated and transferred from the French publication already mentioned, and whose accuracy I perceive no reason to doubt, are introduced here in order to show that the subject has not been lightly considered. They prove that the two principal obstacles to the creation of a ship channel across the isthmus are the bars at the respective mouths of the Huasacualco and Bocabarra. Now, the bar at the mouth of the first of these rivers ceases to be an impediment as soon as its main submarine canal, over which twenty feet of water have been found, is fixed with accuracy and marked by lines of buoys; and the bar at the mouth of the other river, within the lake, is removable, either in the manner suggested by Moro, or upon the plan heretofore successfully pursued, under the direction of our corps of topographical engineers, with bars at the entrances of our rivers from the northern lakes. Then, by surmounting the inferior obstacles, —namely, the occasional shallowness of the Huasacualco, and of the lake, either by sinking the bottoms or raising the water, and the short dividing swell of land between the source of the Rio Monetza, running south into the Chicapa, and the source of any one of the streams running north into the Huasacualco—an uninterrupted water highway is effected. There does not, indeed, appear on the whole line of this route any difficulty which the present resources of our science and mechanical art may not vanquish.

We should all, perhaps, prefer a canal of large dimensions, fit to accommodate vessels of every size; and the expenditure for such a one, having reference to the route specially described, is estimated differently at from fifteen to twenty-five millions of dollars. These estimates are liberal, and are probably exaggerated by an imperfect knowledge of the local aids in the presence and cheapness of material and labor which would be furnished. Still, the highest valuation is, in contemplation of the purpose and its incalculable results, far from being appalling. But it may be, that a canal much smaller, and, of course, less costly, would be attended by every substantial advantage; and, indeed, it is even easy to imagine that consequences very salutary and important might flow from leaving inducements to the construction of of two free cities, one on the bank of the Huasacualco, and the other on the bank of the Bocabarra, or the Pacific, as *termini* to a railway. It will appear, from a careful consideration of the commerce which may be expected to direct its course through this passage, that the number of vessels of heavy tonnage and deep draught would bear a small proportion only to those of light tonnage and shallow draught; and, in all probability, the great additional expense incident as well to the construction, as to the keeping up, of a canal on the larger scale, would not be repaid by corresponding advantages. The average burden of vessels from the United States to the ports on the Pacific, including the Sandwich Islands, to China, and on whaling voyages during the years 1845–'46, was short of 400 tons; and I should doubt whether, if this junction were effected, the burden of nineteen-twentieths of the craft passing through it would exceed that engaged in our coasting navigation. A canal adequate to the perfect accommodation of the great influx from our own country might, therefore, exact an outlay of but ten millions; and trans-shipments of large cargoes, though always more or less inconvenient, could be indemnified by the rapidity of transit by steam power. It is hardly necessary to say that the American people, in the event of a speedy restoration of peace, will find themselves in circumstances of extraordinary prosperity, which will enable them to afford, out of the national treasury, to appropriate for five years five millions of dollars for the superior, or two millions for the inferior, order of canal.

Having given you this sufficiently precise description of the contemplated work, showing it to be practicable, and nothing repulsive in its probable cost, let me indulge in a few remarks of a more general character, or rather hints for you to meditate upon.

The chief objects to be attained are, a speedy communication between this country and the western coasts of North and South America, especially with our Territories of Oregon and California; an easy and quick access to China, the groups of the South Sea Archipelago, the Sandwich Islands, Russian settlements, and even, before long I hope, the tempting and untouched treasures of magnificent Japan; and, finally, the facilitating and enlarging of that great source of wealth, as well as nursery of able seamen, the whale fishery.

Now, I cannot resist the impression that this junction of the two oceans at the isthmus of Tehuantepec would Americanize this vast and augmenting portion of the commerce of the world. It would give to the people of the United States the overwhelming advantage of an abridgment, by fully one-half, of geographical distances. Against the merchants of Europe it would give ours two voyages to one. There is scarcely a region in the limitless South Sea, with which a trade would be lucrative, that could not be reached by them in half the time that would be consumed by English, French, Spanish, Dutch, or Swedish navigators. "If," says Mr. Scarlett, "this scheme were realized, it has been calculated that the navigation from Philadelphia to Nootka Sound and the mouth of the Columbia river, which, by Cape Horn, is now 5000 leagues, would be reduced to 3000 only!" In fact, the reduction would be greater. But at this rate what would the reduction necessarily be as regards the navigation in that direction from New Orleans, Mobile, St. Augustine, Savannah, and our entire southern seaboard? The interchanges of commodities between our great and teeming valley of the West, and the rich and rising regions of the Pacific, would be accomplished almost at the mouth of the Mississippi.

Nor can securing, in this way, for our own country, the just benefits of her relative position be made the subject of complaint by other nations. We do not propose—at least I hope not—to monopolize the uses of the canal; on the contrary, it would be thrown open on terms, if not of equality and freedom, of the utmost liberality. Although an artificial structure, reared by the money and policy of our people, I would give it the unchangeable character of a public highway of nations.

Always sincerely yours, G. M. Dallas.

AMERICAN PATENTS.

Annual Report of the Commissioner of Patents, for the year 1846.

Sir,—In conformity to the provisions of the Act of Congress relating to this office, approved March 3, 1837, the undersigned has the honor to submit his annual report.

During the year ending December 31, 1846, the whole number of applications for patents received, is twelve hundred and seventy-two. The whole number of caveats filed during the same time is four hundred and forty-eight. The number of patents issued in 1846 is six hundred and nineteen, including thirteen re-issues, five additional improvements, and fifty-nine designs; classified and alphabetical lists of which, with the names of the patentees, are annexed.

During the same period, four hundred and seventy-three patents have expired, a list of which is annexed.

Three applications for extensions were made during the year; two of which were rejected and one is still pending. Two patents have been extended by Congress during the same period.

The claims embraced in the respective patents issued during the year 1846 are annexed.

The receipts of the office during the year 1846, including duties and fees paid in on application for patents, caveats, re-issues, additional improvements, extensions, and for copies, amount, in the whole, to $50,264·16; of which sum, $11,086·99 have been repaid on applications withdrawn, and for money paid in by mistake.

The expenses of the office, during the year 1846, are as follows, viz:—for salaries, $16,142·97; temporary clerks, $5685·61; contingent expenses, including postage and the fees paid to counsel in two suits recently pending against the Commissioner, in the United States District Court for the Eastern District of Pennsylvania, $7485·19; compensation of the District Judge, $100; library, $675·96; agricultural statistics, $3610·68; amounting, in the whole, to the sum of $33,700·41.

There was also expended, during the last year, under the act of March 3, 1837, for the restoration of records and drawings, the sum of $786·31, and for duplicate models, the sum of $585.

The aggregate of expenditures under the different heads above enumerated, including money paid back on withdrawals, and for the restoration of records, drawings, and models, is $46,158·71, leaving a balance, to be carried to the credit of the patent fund, of $4105·45.

On the first day of January, 1845, the amount of money in the treasury to the credit of the patent fund was $182,459·69, which, with the balance paid in during the year 1846, will, on the first day of January, 1847, amount to $186,565 14.

Although the balance which the office has been able to place to its credit in the treasury during the year just past, in consequence of the decreased amount received on applications for patents, caveats, &c., (there being fewer foreign applications during the last year,) and the additional amount refunded to applicants on the withdrawal of their claims, is not so great as that of the previous year, yet it is more than the average balance of former years, and indicates the flourishing condition and prospects of the Patent Office.

Thus far the office has more than sustained itself, and fully realized the anticipations of Congress when it was re-organized upon its present footing. And if a conclusion may be drawn from the activity of the inventive genius of our countrymen, as exhibited in past years, we may rely confidently in the belief that this useful and noble institution of the government will never become a charge upon the treasury.

The reports of the two principal examiners, giving a very interesting review of the inventions patented at this office during the past year, are annexed.

On reference to them, it will be seen that the year just past has not been without its valuable discoveries, which, if they do not surprise and delight the mind with their novelty and brilliancy, will contribute much to the convenience and welfare of man. It will be seen that almost every field of invention and discovery has been explored by our ingenious, persevering, and indefatigable countrymen, and many very valuable improvements in machinery, and processes of manufacture, brought to light; all contributing more or less to the improvement and progress of society. The operations of this office during the past year prove, as the circle of every year proves, that the inventor is ever the benefactor of his race. His genius bestows its favors on all. The manufacturer, the mechanic, the agriculturist, the merchant—all are recipients of the benefits which flow from his toils, energies, and sometimes his great and sublime conceptions. No theme is more interesting for contemplation than this, and there is none which more deeply impresses the mind with a sense of the continued and onward progress of society in the grand career of civilization.

In my last annual report I embraced the occasion to bring to the notice of Congress the embarrassed condition of this office, in consequence of the great increase of its business, without a corresponding increase of its clerical force, particularly in its scientific department.

When the office was re-organized, in 1836, the Commissioner was allowed but a single examiner. By the 11th section of the act of March 3, 1837, an additional examiner was authorized to be appointed; and by the act of March 3, 1839, two assistant examiners were provided for; since which time no addition to the examining corps has been authorized, and none has been made.

In 1840, the first complete year after the last addition to the examining force was authorized, the number of applications for patents received was 765, the number of caveats filed 228, and the number of patents granted 475.

During the year 1846, the number of applications for patents was 1272, the number of caveats filed, 448, and the number of patents granted, 619. During the same year, the number of applications for patents which were examined and rejected was 398.

Thus does it appear that, since the last addition to the examining force in 1839, the business of the office has increased nearly one hundred per cent. It has increased beyond the physical ability of the present examiners and assistants to keep up with it, although constantly and industriously engaged in the performance of their onerous and fatiguing duties. The consequence is, that business accumulates upon their desks; applicants are delayed in having their cases examined, often to their great detriment, and always to the injury of the office; which is complained of for its delays by persons not knowing the condition of its business and the inadequacy of its force, when it is constantly exerting itself to the utmost to accommodate the public, as well as to relieve itself from inconvenience resulting from a pressure of its duties.

When it is considered that the Patent Office derives its revenues entirely from the inventors, and sustains itself without charge upon the treasury, the justice of their complaints cannot be denied nor evaded. But I am confident they cannot attach to the Patent Office, nor to any of its officers. The state of its business was fully presented to Congress in my last report, and again in a subsequent communication addressed to the chairman of the Committee on Patents and the Patent Office of the Senate at the last session.

It is therefore respectfully submitted, whether, in view of the fact that its revenues are ample for the increased expenditure, which will in that event be required, it is not expedient for Congress to authorize the addition to the examining corps which the present state of the business of the office imperatively demands.

By the 11th section of the act of March 3, 1837, I am authorized to employ all necessary temporary clerks for writing and copying, at a compensation of ten cents for every hundred words. This provision enables me to provide for any exigency in the clerical department of the office. No addition, therefore, is deemed necessary to this branch of service in the office.

In connexion with the subject of an increase of the scientific force of the Patent Office, I would again respectfully suggest the propriety and expediency of increasing the salaries of the principal and assistant examiners. This subject was brought to the attention of Congress by my predecessor in his last annual report, and its expediency and justice portrayed with great force as well as earnestness. Convinced, from my own observation, of the justice of his recommendation, I cordially concurred with him in the views which he expressed, and enforced the recommendation with such additional reasons as my own experience had placed at my command.

Deeming it unnecessary to repeat the reasons in favor of the proposition, which I again submit, I would respectfully refer to the last report of my predecessor previous to his retiring from this office, and to my own of the last year, for all the information which is deemed necessary to enable Congress to come to a correct conclusion in relation to the subject.

But I would again refer to the able and interesting reports of the examiners attached to the reports of the Commissioner for the last two years, and to this report, for proof of the talents and scientific qualifications requisite to enable the incumbents to fill those laborious and responsible desks with credit to themselves and usefulness to the country. The remark may be safely hazarded, that there are but very few offices in the government which require more ability for sound and nice discrimination, more extensive and varied acquirements, and, it may be added, more inflexible integrity of character, than the office of examiner of patents.

The revenues of the Patent Office are ample for the proposed increase of force and salaries in the examining corps; and the interests of the public, as well as of the inventors, require that it should be made.

In my last annual report I had the honor to submit to Congress a proposition for certain modifications of the existing patent law, which I deemed important and necessary for the protection of the inventor as well as the public. A bill, embodying most of the modifications suggested, was reported in each House by the committees having the matter in charge; but in consequence of the great amount of business pressing upon Congress at the last session, it failed to become a law.

The bill provided for two important and essential changes in the existing law in relation to patents. One of those provisions was, that in all suits brought by the patentee for infringements of his invention, the letters patent securing his invention should be received by the courts trying the same as conclusive evidence of his right to recover damages, until they were set aside by the institution and prosecution to final judgment of a process for their repeal. The other was a provision for the institution of a process for the repeal of letters patent which had been obtained by fraud, misrepresentation, or upon false suggestion, or which were void, in whole or in part, for want of novelty, or other cause. The very inadequate protection afforded to the patentee by the present law, seems to me to furnish sufficient reason for the proposed modification.

After the rigorous and searching ordeal through which every invention passes at the Patent Office, it certainly seems reasonable that the letters patent, under the seal of one of the offices of the government of the United States, should be received in courts of justice as conclusive evidence of the title of the patentee to his invention, and his right to recover, until his patent shall have been revoked and annulled for good and sufficient cause, by a tribunal competent to investigate the matter.

But the present law extends no such protection to the patentee. At present his letters patent are only *presumptive* evidence of the novelty of his invention, and of his right to recover. Consequently, the validity of his patent may be, and for the purposes of embarrassment often is, put in issue in suits for infringement, and he is compelled to prove the novelty of his invention over and over again, as often as the depredator upon his rights, whom he seeks to punish, is disposed to put him to that trouble.

Many instances of this wanton aggression upon the rights of the meritorious inventor have come to the knowledge of the undersigned since he has had the honor to be at the head of the Patent Office. And many of these instances of aggression proceed from wealthy and powerful companies and corporations, and the subjects of them are the inventors of the most useful and valuable machines and improvements. The more valuable the invention, the more liable is it to piracy and infringement. These wealthy and powerful bodies know well the benefit to them of the law's delay, and its ruinous expense to the single handed individual who dares to resist their unlawful and unjust invasion of his rights; and hence, in the end they hope to win, either by the defeat of the patentee by means of some trifling defect in his title deed, or his inability to procure the necessary evidence to substantiate his right, or by a compromise, in which he will be forced to sacrifice a portion of his claims in order to relieve himself from the embarrassment and expense of the unequal contest.

As the law now stands, the great burden of the controversy falls upon the patentee, and not upon the wanton violator of his rights, as it should.

In this view of the matter, I think all candid men will agree that when a patentee has established, in the judgment of the office or tribunal whose duty it is to pass upon his claims in the first instance, a right to letters patent of the United States, that document should be his shield and protection until it is shown by others, who dispute his title, that he has no right to it.

I am aware that there is a prejudice existing in the minds of a portion of the community (small I believe it is) against the claims of inventors. It is contended by some that patents securing exclusive rights to the discoverers of new machines, or processes of manufactures are monopolies, operating to the detriment of the best interests of the community, and existing against the true policy of all just governments; and, therefore, are to be regarded with suspicion, construed with great strictness, and defeated if possible.

I am fully persuaded that, on a little reflection, such a view of the rights of inventors will disappear from the minds of candid and reasonable men. What are the grounds on which all civilized and enlightened governments grant to persons making valuable discoveries in the arts and manufactures a limited monopoly of the benefits of their inventions? The main ground is to encourage discovery and invention—those great agents of social improvement—by securing to those who make them the profits which result from them, in order to enable them to remunerate themselves for their toils and expenditures, and to induce others to explore the vast and limitless field of invention.

Every new discovery in science and art contributes to the wealth, convenience, and comfort of individuals, and to the improvement of society. Some of the inventions of the last few centuries have burst upon the world with the brilliancy of the morning sun, changing the whole aspect of society, and conferring incalculable benefits upon the human race. I need mention only the art of printing, the discovery of gunpowder, the steam engine, the cotton gin, the spinning jenny, the power loom, the steamboat, the railroad, and the magnetic telegraph. These great discoveries in science and art have revolutionized the condition of the civilized world, and their influence at this moment is probably more potent and more sensibly felt than ever before.

I mention these great discoveries as striking instances of the effect of the labors of the inventors upon society and civilization. There are others, of less note, producing their due influence upon the condition and welfare of the world. Even the most humble discovery contributes its due proportion to relieve the human family of its burdens, and administer to its comforts, and to accelerate and aggrandize its unceasing and triumphant progress in the improvement of its condition, and the expansion and perfection of its lofty nature and destiny.

Therefore, there is ample reason why society should reward and encourage that class of its benefactors whose claims I am now considering, by securing to them, for a limited term, the exclusive enjoyment of the fruits of their genius and labors.

But it cannot be denied that, upon the principles of abstract justice, the inventor has a complete and unquestionable claim to the fruits of his discoveries until his labors and sacrifices are adequately remunerated.

Many valuable and profitable discoveries in the arts are the result of a sudden and lucky conception in a happy moment; but most of them are the fruits of days and years of incessant toil, anxious and harassing thought, and great pecuniary sacrifices. This toil, this mental effort, and these pecuniary sacrifices, establish a title to the product which is their offspring, as sacred and irrefragable in the eye of justice as the title to his farm, his workshop, or his merchandize, which a man has acquired by his labor, skill, and economy. So clear and convincing is this view of the right of the inventor to the fruits of his genius and labor, that argument in its support would seem to take from its strength. Yet the reasons are equally strong that the inventor's exclusive enjoyment of his discoveries should not be perpetual, but should be permitted only for a limited period.

All inventions, great and small, generally have their period of birth, growth, maturity, and perfection, if the latter term be allowable. And if one mind conceives and gives birth to the first idea, many assist in its development and expansion. Probably no piece of mechanism was ever made which was perfect in all its parts at its first creation. The steam engine is an interesting and beautiful illustration of the gradual progress of an invention, from its first conception in the mind of the inventor to its present wonderful state of perfection and efficiency. It first appeared in a rude form, unwieldy and dangerous to those who dared to operate it—a thing designed more for experiment than utility; and now, after passing through nearly two centuries of improvement, and taxing the highest intellectual energies of thousands of ingenious and skilful men, it appears to us with a perfection, in the nice and delicate adjustment of its machinery, which astonishes and delights us, and an efficiency and power of action which enable it to confer the greatest and most lasting benefits upon mankind.

The history of this wonderful engine and instrument of civilization shows as clearly and conclusively that the claims of the inventor to the fruits of his genius should not be perpetual, as it does that he should be permitted to enjoy them until he is adequately remunerated for his labor and expenditures. For, if his right to his invention were perpetual and exclusive, no other person could improve it, because he could not use his improvement with the original invention, and therefore not at all. This would immeasurably retard, if not wholly prevent, all improvement of original inventions, and would result in incalculable injury and mischief to society.

Hence, while admitting the unquestionable justice of the claim of the inventor to the fruits of his genius for a period of time sufficient to enable him to remunerate himself adequately for his toils and expenses, it is absolutely necessary, for the progress of improvement and the welfare of society, that his exclusive right should then cease, and his invention become the common property of the public. Others will then have an opportunity to remedy the defects of, and to improve and perfect, his original creations.

And, in accordance with this view of the subject, the constitution of the United States authorizes Congress to enact laws for the promotion of the useful arts, and the protection of the inventor in the enjoyment of the fruits of his genius and skill for a certain period, the duration of which is limited to fourteen years; at the end of which time, in consideration of such protection, his invention, and the secret of it, shall become the property of the public.

I have been thus particular in setting forth the general principles of the patent law, because, as before remarked, a prejudice prevails to some extent in the community against the justice of the claims of the inventor to temporary protection in the enjoyment of the fruits of his labors. I am, however, happy to see that juster sentiments are growing more prevalent in relation to the rights of that valuable and meritorious class of citizens. During the past year, courts of justice have displayed a more earnest desire to give protection to the inventor, as evinced by the liberal construction which they have given to the present imperfect patent law, whenever questions relating to patents have come before them for adjudication.

The bills reported by the respective committees of the two houses contained other provisions less important than the two which I have been considering, deemed, however, to be necessary modifications and improvements of the existing law in relation to patents; but, as they were particularly explained in my former report, it is unnecessary further to consider them.

In connexion with the subject of the amendment of the existing patent law, I would respectfully suggest the expediency of making some new provision in reference to the applications of the citizens and subjects of other countries for letters patent in the United States.

By the existing law, a subject of Great Britain is required to pay into the treasury a duty of $500 before his application can be examined. The citizens and subjects of all other foreign countries, are each required to pay into the treasury a duty of $300 on their respective applications. These duties were designed to bear some proportion to the duties required of American citizens making applications for patents in other countries, and on that ground may, perhaps, be justified and defended.

The effect of this provision is unquestionably to prevent the introduction into this country of many useful and valuable discoveries, which would otherwise be patented and introduced. Similar high duties have the effect to exclude American inventions from other countries. Thus all countries are injured by this system of taxing genius for the exertion of its powers, in order to obtain comparatively a very small and trifling amount of revenue.

It affords no protection to the American inventor to keep out the discoveries of his foreign emulator (not rival) in the arts, by taxing the emanations of his genius with high duties, while the country would derive much benefit from their introduction.

Therefore, it is respectfully submitted whether it would not be expedient, if Congress should make the amendments to the patent law already proposed, also to provide contingently for the reduction of the duties required on application for patents by the citizens or subjects of foreign governments to thirty dollars, whenever it shall appear that corresponding reductions have been made, by those governments, of the duties required of American citizens. I have reason to believe that the proposition would be received with favor by some, if not all, of the European governments.

As constant inquiry is made, by citizens residing in all parts of the Union, for information in relation to the laws of foreign governments respecting the granting of patents, I have, for the accommodation and convenience of such persons, caused abstracts to be made of the legislative provisions and ordinances of all foreign governments of which this office is in possession, which are hereto annexed.

The law providing for the admission of Texas into the Union failed to make provision for the transfer to this office of the records, models, and drawings of the patent office of Texas. Nor has there yet been made by Congress any provision by which patents granted in Texas, before the admission of that state into the Union, shall be valid in the United States. Under the new relations of that State to the Union, it would appear to be necessary for the public convenience, and the protection of those citizens of Texas who obtained patents under the government of that State when existing as an independent republic, that the contents of the patent office of Texas should be transferred to this office, and that such legal provision should be made by Congress as may appear to be necessary to secure the validity of all patents granted under the authority of that State prior to its annexation to this republic.

Congress, at its last session, having declined to make the usual appropriation for the annual agricultural report made by this office, I regarded the act as an instruction to me not to prepare a report of that character for the year just past, and accordingly none has been prepared, and none will, of course, be made to Congress at its present session.

Whether or not such a report as this office has been required to make for some years past upon the state of the crops, the amount of agricultural products, and the discoveries and improvements in the science and practice of agriculture, is of any value to Congress or to the country, it is not for the undersigned to affirm.

Yet it is respectfully submitted that from no other source could so much accurate and valuable information in relation to the condition and progress of agriculture be obtained, as from the reports of this office upon that subject; of course, not referring to the report of last year.

The remark, I am confident, may be safely hazarded, that from no other source could such accurate estimates of the amount of agricultural production of each year be obtained as from the reports of this office; as the statement of a few facts, showing the ground on which those estimates were made, will clearly prove.

In the first place the office assumed the returns of the census of 1840 as the basis of its estimates. It then observed the progress of the growth of each crop in each succeeding year in every district and county in the Union, from the planting of the seed until the harvest of the matured crop; carefully noting, day by day, and week by week, all the causes which operated favorably or unfavorably upon it; the effect of the weather, the ravages of insects, the effects of blight and mildew, and decreased or additional cultivation.

This extended system of observation it was enabled to adopt through the aid of agricultural and other newspapers and journals, and of letters from distinguished practical agriculturists, received from every neighborhood in our widely extended country. To show the extent of this system of operation, it is only necessary to state the fact that the great number of five thousand newspapers, journals, and letters were carefully read and examined in making up the report for the last year.

It may, therefore, be safely assumed that no institution or association of individuals in the country, had such extensive means at command for estimating the amount of agricultural products within the Union, as were in the possession of the Patent Office.

Of course, it is not intended that the estimates of this office were mathematically precise and exact, for, in relation to such subjects, precision and exactness are absolutely impossible. It is only assumed for them that they approximated as near to precision and exactness as the nature of the subject rendered it possible to approach to certainty. But their general accuracy and value are sufficiently proved by the fact that they were received in this and foreign countries as the best and most reliable estimates of the amount of the agricultural products of this country that could be obtained from any source. And they are cited and referred to in public documents, and in the leading journals of trade and commerce, as the only authentic estimates of the crops of the United States worthy of reference and confidence.

Assuming the general accuracy of those estimates, it is hardly necessary to speak of their value. The time has gone by when legislation for great communities is to be based upon theories or abstract axioms in political philosophy. Facts, now, are deemed the only solid foundation for the superstructure of the modern statesman. And without a knowledge of the statistics of a nation, which embrace every fact relating to its condition and welfare, physical, moral, or political, it is almost impossible to legislate wisely for its interests. And no statistical knowledge is more important than that which exhibits the resources of a nation, as indicated by the products of its labor. An important part of that knowledge the agricultural estimates of the Patent Office were designed to furnish. Another object of the agricultural report of the Patent Office was to collect and embody every fact within its reach, which tended to show the improvement and progress of agriculture in the United States during each year; and, in order to accomplish this result, so desirable and so valuable to the agriculturist, every new discovery in the science of agriculture, and those kindred and auxiliary sciences from which it derives its most essential aid—namely, geology, chemistry, and botany—and every new improvement and experiment in the practice of agriculture, in this and all foreign countries, were carefully noted, collected, and embodied in a form which enabled every intelligent citizen to see and comprehend the progress of that greatest and noblest occupation of man during the year. In order to perform this portion of its duties, this office was amply provided with the ablest and most approved publications of this country, England, Scotland, France, Germany, and Prussia, not only relating directly to the science of agriculture, but to all branches of science with which it had immediate or remote connexion. It also availed itself of the labors of eminent experimenters in our own country, who kindly and generously communicated to the head of the office the results of their labors and experiments.

All this mass of valuable information collected from a thousand different sources was embodied and presented in a comparatively narrow compass to the American agriculturist, and at a comparatively small expense to the treasury.

I think it may be safely affirmed that in no other country in the world was so large an amount of valuable information collected and presented to the people at so little expense, the annual appropriation to this office for the purpose not exceeding $3,000 per annum. In proof of this remark I would refer to a single fact. The importance of the potato crop—the annual value of which is equal to one-half the value of the whole cotton crop of the Union—which has, during the last three years, been greatly injured by the ravages of that remarkable and fatal disease which has assailed the potato in the northern and middle States, and in most of the countries of Europe, rendered it, in my judgment, expedient to collect and embody every fact which would tend to throw light upon the origin and progress of the disease, and if possible point out the remedy. With that view a large portion of the report of the last year was devoted to that subject, and a large amount of valuable information respecting it collected, and at very little expense. During the same year a commission, composed of eminent scientific gentlemen, was appointed by the British government to proceed to Ireland and investigate the potato disease as it appeared in that island. The expenses of the commission amounted to nearly $90,000; yet the results of the labors of that enlightened committee, which were very valuable, were all embodied in the agricultural report of the Patent Office, with twenty-fold as much more upon the same subject.

The alarming nature of the calamity which had befallen the potato attracted the attention of many of the governments of Europe, but from none emanated publications containing so large an amount of valuable information upon the subject as the report from this office. The industry of this office, in collecting information in reference to this subject, enabled it to answer the inquiries of many of the governments of Europe.

It is unnecessary to refer to other subjects connected with agriculture which were embraced in the reports of this office. It is believed that the value of the services of this office in relation to the interests of agriculture are appreciated by that great and intelligent class of the people engaged in agricultural pursuits, as would seem to appear from the expressions of numerous letters and public journals received at this office.

If Congress had deemed it expedient to continue the report, several valuable improvements and additions to it were contemplated. A larger field of inquiry had been marked out than had been previously investigated. It was designed to embrace within the scope of future investigation additional crops and products, the amount of cultivated land in the Union, the statistics of the movements of agricultural products from the interior to the commercial marts and their export to foreign countries, the prices of agricultural products, the wages of labor, &c., &c ; which, connected with the information previously furnished in a more condensed form, would not have failed to add to and increase the value of the report.

I am aware that it has been objected against the agricultural report of the Patent Office, that it was unauthorized by the constitution, and that, if permitted to be continued, it would endanger the liberties of the people.

If collecting and laying before the country valuable and statistical information is unconstitutional, I have no argument with which to meet the objection; and I am equally unable to comprehend how the operations of this office, connected with agriculture, can endanger the government or the people. It has not its thousand agents scattered through the country, to impress its influence unduly upon the public mind; it has but little money to expend, and no patronage to bestow; its operations are silent and unseen, and they are as harmless as they are silent. Its whole expenditure in this branch of its duties amounts to but a few hundred dollars, and most of that small amount goes in payment of clerks, the purchase of seeds, and in subscriptions to agricultural publications: but these objections require no further answer.

Nor should it be forgotten that the Patent Office has been instrumental, within the last few years, in introducing into the country many varieties of grains and vegetables; and it has aided much in introducing into the newly settled portions of the Union valuable varieties of grains and vegetables well known in those portions of the Union which have been longer settled, and are more highly cultivated; and, although the popular names of the varieties of seeds it has distributed have given occasion for ingenious irony and dignified ridicule, from sources evidently but little acquainted with such humble yet important matters, no seeds have received names at this office for the purpose of imposition or deception, and none have been distributed which have borne names not familiarly known to every intelligent farmer and horticulturist in the country.

All the varieties of grains and vegetable seeds distributed from this office may not have been valuable. Many, from want of adaptation to soil or climate, may not have been successful—perhaps not germinated; but, if one valuable variety of either is introduced from abroad, or disseminated in parts of the Union in which it was not before known, the trifling cost of the operation is a million times repaid, and the cause of agriculture is promoted.

It has also been objected that the agricultural duties of this office have been assumed without authority of law, and were therefore a grave abuse and usurpation of power. It is not proper, perhaps, for me to vindicate the conduct of my predecessor under whose administration of the office it was introduced. It will not, however, be irrelevant to remark, that the subject had been a matter of serious consideration by the committee of the House of Representatives upon the Patent Office during the session of 1839—'40, and the Commissioner was then requested, by the able chairman of that committee, to communicate to the committee "any information relative to the collection and distribution of seeds and plants; also, the practicability of obtaining agricultural statistics, with the addition of any suggestions deemed important in relation to those subjects."

That inquiry was answered by the Commisssioner in the liberal and enlightened spirit in which it was made, and the collection of agricultural statistics and the distribution of seeds and plants by the Patent Office were santioned and provided for by Congress, by small appropriations made each year, with one or two exceptions, since.

That a department or bureau of government should devote a portion of its duties to the important interests of agriculture, is no new thing in the history of nations. Most, if not all of the leading governments of Europe, have departments charged with these responsible duties, under the supervision of officers called Ministers of the Interior. And such a department seems to have been contemplated by President Washington and the earlier statesmen of the republic.

In the message of General Washington to Congress, in December, 1796, an agricultural or home department is recommended by that revered and illustrious statesman and patriot. In 1812, it was again recommended in a most able and enlightened report, drawn up and presented to the House of Representatives by the Hon. Adam Seybert, chairman of the select committee appointed to inquire into the state of the Patent Office. And again, in 1817, the subject was considered by a select committee of the House of Representatives, which, through one of its members, the Hon. M. Hulbert, reported in favor of the establishment by Congress of a National Board of Agriculture.

The views of the committee were expressed in the following brief and emphatic language: "The extent of territory, and the richness and consequent productiveness of the soil of our country, can never fail to invite and employ in the cultivation of the earth far the greater portion of American industry.

"The interests of agriculture must therefore be primarily important to the people of the United States, and must at all times deserve the warm support and liberal patronage of government. The committee observe, with pleasure, that President Washington, in his speech to Congress of the 7th of December, 1796, recommended to that body the interests of agriculture, and the establishment of a national board to promote the same.

"In different parts of Europe, as well as in several States of this Union, such boards have been instituted under the auspices of government, and have diffused much useful information, and contributed largely, as the committee believe, to the public welfare.

"After due consideration of the subject, the committee are of the opinion that it is advisable to establish at the seat of government a national board of agriculture, and report a bill for that purpose."

It is not recommended, nor is it desired by the undersigned, that any such department, or national board of agriculture, should be instituted by this government. The practices of other enlightened governments are referred to only to show that the exercise of such functions by government is not without precedent, nor without utility.

The concurring testimony of a very large number of intelligent citizens from every State and district in the Union, received at this office, furnishes convincing proof of the beneficial influences of the agricultural reports of the Patent Office. They have been distributed, through the agency of Congress, to every district in the Union; they have penetrated every neighborhood, and been read in almost every family; and they have awakened an interest upon the subject of agriculture among the intelligent farming classes of our population not before exhibited nor felt. If they have not always led to efforts to improve, they have produced in the mind even of the humbler agriculturist a conviction of the true dignity of his noble avocation, and of its first and transcendant importance among the great interests of his country. If they had produced no other effect, the money which they have cost would not have been idly expended.

Nor should it be forgotten that it is the only expenditure which has been made by Congress for the especial benefit of the agricultural classes; the only expenditure for an interest in the pursuits of which ten-fold the amount of capital is invested that is invested in any other pursuit; many times the amount of value annually produced that is produced by any other interest; and many times the number of persons employed that are employed in all the other great interests of the country put together. Yet how much is expended, and how much time is employed, in legislating for those other interests, and how little for agriculture!

All which is respectfully submitted,

EDMUND BURKE,
Commissioner of Patents.

Patent Office, Jan., 1847.

List of American Patents which Expired in 1846.

Acid, Vegetable	N. S. Allison & B. Kugler, Philada., Pa., June 5.
Alarm bell for time-pieces,	Robert Wilson, Williamsport, Pa., July 3.
Alcohol for stiffening hats,	William McCay, Northumberland, Pa., June 22.
Andirons,	William Wilson, Greenfield, Mass., May 16.
Apples, grinding, and shelling corn,	Harris, Newton, Webster & Dart, Truxton, N. J., March 10.
Do. do. do.	Jonathan K. Deane, Augustus, Ohio, April 5.
Awl haft,	David M. Smith, Gilsum, N. H., October 25.
Axes,	Jonathan Pratt, Jr., Charlemont, Mass., April 6.
Do.	Benjamin Smith, Canton, Conn., Nov. 2.
Do. hatchets, &c.,	David Hinman, Winchester, Conn., Nov. 2.
Do. Oval	Asahel Collins, Winstead, Conn., Oct. 25.
Axletrees, friction rollers	Francis Rees, Clarksville, Ga., April 14.
Baker, Reflecting tin	William Prescott, Boston, Mass., May 24.
Do. and roaster, Double reflecting	Samuel Hasey, Rensselaerville, N. Y., Dec. 28.
Balance, Compound lever	Jared B. Whetmore, Rush, N. Y., Feb. 27.
Do. Steelyards	E. & T. Fairbanks, St. Johnsburg, Vt., Sept. 22.
Do. Do. &c.,	Do. do. do. do.
Do. weighing heavy bodies	Do. do. do. Feb. 21.
Bank notes, Preventing counterfeiting	J. Peabody & J. Dixon, Salem, Mass., April 20.
Bark mill,	James T. Gifford, Veteran, N. Y., Feb. 27.
Do. do.	D. Hamberd & G. Downs, McConneltown, Pa., March 27.
Barrels for oil,	Barnabas Springer, Henry county, Ind., April 27.
Bath, Elastic cot	W. C. Palmer, New York, N. Y., Nov. 24.
Do. Applying steam	Boyd Reilly, Philadelphia, Pa., July 31.
Bedbugs, Destroying by steam	Benj. Overman, Greensborough, N. C., June 22,
Beds, Cork for filling	Stephen Bates, Boston, Mass., Dec. 28.
Bedsteads,	Cornelius Van Noy, Lexington, Ky., Jan. 10.
Do.	Bethel Judd, New London, Conn., May 25.
Do.	Henry Reisinger, York, Pa., Aug. 18.
Do. fastenings,	Hardin Branch, city of New York, April 18.
Do. do.	John Richman, Lancaster, Ohio, Dec. 28.
Do. sofas, settees, &c.,	John P. Allen, Manchester, Mass. May 19.
Beer or ale, Restoring sour	Moses Granger, Lowville, N. Y., Jan. 14.
Do. Making spruce	George Jones, Boston, Mass., Jan. 27.
Bells for cows or sheep,	Samuel Booth, Berlin, Conn., June 1.
Binnacle lights,	William Lawrence, Meriden, Conn., Nov. 14.
Bleaching Bayberry wax	Benjamin Gomperts, city of New York, Feb. 14.
Do. yellow beeswax,	John A. Shultz, city of New York, April 30.
Do. cotton, linen, &c.,	John B. Green, Portsmouth, N. H., May 29.
Boards, Shearing	Simon Willard, Cincinnati, Ohio, May 9.
Do. &c., Seasoning, &c.,	Abraham Plumb, Buffalo, New York, April 6.
Boilers, Steam, Supplying with water	Jesse Fox, Lowell, Mass., March 14.
Books, Cutting	Archibald O. Douglass, Philada., Pa., Jan. 6.

Boots, Crimping	Silas Wetherby. Essex, Vt., May 12.
Do. do.	Lewis Lucas, Barre, Vt.. July 25.
Do. &c., Gum elastic soles	Wait Webster, city of New York, May 19.
Do. Pegging machine for	William B. Randall, Fayette, Maine, April 6.
Do. do. do. do.	Frederick Gray, Rowley, Mass., April 6.
Do. Taps for soles	Stillman Knowlton, Athol, Mass., Oct. 25.
Boxes of wood,	Harrison Holland, Belchertown, Mass., April 13.
Brand for flour barrels,	Samuel Huse, Newburyport, Mass., June 28.
Bricks, Moulding	John Drummond, Whitestown, N. Y., March 6.
Do. do. and pressing	Daniel Barnford. Deerfield, N. Y., April 28.
Do. do. do.	David Phillips, Natchez, Miss., June 23.
Do. press,	David M. Crellis, Sandwich, N. H., Aug. 11.
Do. Stock, tile, &c.	D. Flagg, Jr. & A. Parker, Sweden, N. H., Dec. 28.
Brush, broom, &c., handles,	Evans Turk, Harrisburg, Pa., May 18.
Buds, Delaying blossoming	Robert Moore, Rowan county, N. C., March 16.
Buildings. Securing from fire,	Ebenezer Mix, Batavia, N. Y., Nov. 22.
Bungs. Manufacturing	Robert Barlow, Philadelphia, Pa., Dec. 1.
Canal locks, Securing water in	James Dewees, Pottsville, Pa., Dec. 31.
Candles, Dipping	John Aborn, Trenton, N. J., May 19.
Cannon, Primers for percussion	Joshua Shaw, Philadelphia, Pa., Dec. 31.
Car, Railroad	John C. Blauvelt, Rockland county, N. Y., July 11.
Do. do.	Isaac Cooper, Baltimore, Md., Oct. 25.
Do. do.	Samuel Snyder, Lancaster, Pa., Nov. 10.
Carding machine,	Robert Bartlett, Ripley, Ohio, Oct. 25.
Do. do.	Luther Colburn, Fairfield, Vt., Nov. 20.
Cards, boards, &c.,	Homer Whittimore, Newton, N. Y., April 27.
Do. Cotton and wool,	Edward Faber, Pittsburg, Pa., Jan. 24.
Carriages, Disengaging horses	Robert Beale, Washington, D. C., May 12.
Cement for wood. brick, &c.,	Richard Walsh, Boston, Mass., Jan. 5.
Chimneys, Preventing smoking, &c.	Jeremiah Sullivan, Washington, D. C., April 27.
Churn,	John H. Brunwer, McKean, Ohio, Feb. 9.
Do.	Jedediah Darrow, Warren, Ohio, June 2.
Do.	William Loomis, Ashford, Conn., June 2.
Do.	Jesse Ladd, Holderness, N. H., June 22.
Do.	Simeon Power, Lawrenceville, Pa., June 23.
Do.	Isaac Van Gorder, Warren, Ohio, June 27.
Do.	James Bennett, Brutus, N. Y., July 25.
Do.	Caleb C. Knowles, Fayette, Maine, August 2.
Do.	Anthony C. Carrell, Greenville, Ohio, Oct. 25.
Do.	Joseph Rickey, Centre township. Ohio, Oct. 25.
Do.	Eli Willemin, Salem township, Ohio, Oct. 25.
Do. Balanced lever	Caleb Angevine, city of New York, April 19.
Do. Revolving dasher	Hardin Branch, city of New York, April 18.
Clay, Mixing	Jesse Chapman, Mad River township, Ohio, June 2.
Do. do. & making brick	D. Phillips & J. D. Drummond, Whitestown, N. Y., May 15.
Clocks,	Rufus Porter, Billerica, Mass., June 22.
Do.	James S. Seger, city of New York, Nov. 27.
Do. striking part	George Parker, Ithaca, New York, April 7.
Do. do.	James Bogardus, city of New York, May 18.
Clothes vice,	Samuel Prior, Salem, N. J., March 22.
Coaches, barouches, &c.,	Robert Gedney, city of New York, April 7.
Cock,	Jacob Bright, Sunbury, Pa., June 22.
Do. To prevent freezing in pentstocks, &c.,	Dixwell. Lathrop, Jr., Norwich, Conn., Dec. 5.
Coffee mill, Double	T. H. Wetherly & J. Torrey, Milbury, Mass., July 17.
Do. and spice mill,	E. Parker & H. White, Meriden, Conn., June 22.
Do. do.	Ammi Clark, Berlin, Conn., July 20.
Combs, Preparing tortoise shell, &c.,	Reuben Munsen, city of New York, May 22.
Compass, Surveying	William J. Young, Philadelphia, Pa., Jan. 17.
Constructing boats & vessels	Albert Dorman, Norfolk, Va.. Oct. 25.
Cooking apparatus,	S. D. & W. T. Day, Westfield, Mass., June 8.
Do. do.	James Bennett, Brutus, N. Y., July 25.
Do. stove,	Horace Bartlett, Bridgeport, Conn., May 12.

Cooking stove,	Henry O. Foote, Dover, N. H., Dec. 7.
Do. do. Coal	David Gassner, city of New York, April 11.
Do. do. and fireplace,	Edward Potter, Providence, R. I., May 8.
Do. do. Portable	Stephen J. Gold, Cornwall, Conn., Aug. 29.
Do. do. Revolving	Henry Stanley, Poultney, Vt., Dec. 7.
Corn shelling, grinding, &c.	Daniel Mullier, Worcester, Ohio, Jan. 21.
Do. do.	William Gee, Prince George county, Va., May 10.
Do. do.	Christian Thomas, Lancaster, Pa., Sept. 3.
Do. do.	Michael Carpenter, Lancaster, Pa., Oct. 25.
Do. do.	Daniel Hall. Strasburg township, Pa., Nov. 12.
Counterfeit figure, Lathe to prevent	David H. Mason, Philadelphia, Pa., June 7.
Cracker and biscuit cutting,	J. & C. Bruce, King's county, N. Y., March 13.
Croup in poultry, Curing	T. V. Bush, Clark, Ky., June 27.
Cultivator, or harrow,	Waldren Beach, Philadelphia, Pa., Oct. 25.
Cutting sausage meat,	John Brannon, Baltimore, Md., March 8.
Do. do. do.	Charles Otis, Greene, Pa., Nov. 29.
Diamonds, Setting	John Dickinson, Philadelphia, Pa., Nov. 30.
Distilling,	Jacob Miller, Lancaster, Pa., Feb. 16.
Do.	Lewis Johnson, Easton, Pa., Nov. 9.
Dock, Dry	David Brown, city of New York, Feb. 11.
Do. Floating screw	S. H. Stinchfield, New Orleans, La., April 27.
Door fastener,	Calvin Washburn, Bridgewater, Mass, April 18.
Door springs, Vertical wire	John Codman, Boston, Mass., Dec. 28.
Doors,	Eastman R. Ball, Oswego, N. Y., April 5.
Dough, Kneading	N. C. Willett, Jonesborough, Tenn., Dec. 28.
Dyeing with alkaline prussiates,	Felix Fossard, Pittsburg, Pa., Dec. 14.
Faucets, Spring lever	Charles Goodyear, Philada., Pa., March 16.
Felt, Washing, &c., paper-makers'	Samuel E. Foster, Brattleborough, Vt., May 25.
Fenders, Shaping fire	T. Thomas & R. Fuller, city of New York, Nov. 19.
Fire-arms,	J. W. Plummer & J. Clark, Wayne township, Ohio, May 17.
Do.	James B. Porter, Girard, Pa., Aug. 4.
Do. Loading and discharging	P. A. Morineau, Philadelphia, Pa., Oct. 19.
Fireplace for burning coal,	Artemes Torrel, Boston, Mass., Oct. 25.
Flax and Hemp, Breaking & dressing,	Ebenezer C. Chase, Jay, Me., Jan. 6.
Do. do. do.	Arnold Zellnor, Giles county, Tenn., Oct. 25.
Fomentation, Applying, &c.,	T. L. Jennison, Cambridge, Mass., Aug. 30.
Forges, Backs for and other fires,	Philo P. Curtis, Utica, N. Y., March 22.
Do. do. for fires, &c.,	Asa Graham, Hamilton, N. Y., Dec. 25.
Friction rollers,	James D. Cobb, Lebanon, Ohio, June 22.
Fur, cutting from pelt	Denison Williams, city of New York, Oct. 25.
Fur, Separating from hair,	C. Lockwood, R. Lockwood, & J. Arnold, Fairfield, Conn., Dec. 4.
Furnace, Blast, for iron ore,	Thomas Gregg, Connellsville, Pa., May 22.
Do. Hot-air & bake oven	Jacob Stone, Baltimore, Md., May 29.
Garments, Tailors' square delineating	Andrew Weswell, Exeter, N. H., June 7.
Gate purchase, Rotary	I. Musser & L. B. Gitchell, Canton, Ohio, Feb. 11.
Glass, Flattening	John J. Adams, Washington, D. C., April 21.
Do. hones,	A. Gordon & J. P. Bakewell, Pittsburg, Pa., Dec. 8.
Do. Machine for blowing	Joshua Laird, Pittsburg, Pa., Dec. 14.
Do. for orreries, &c.,	Morris J. Gardner, York, Pa., April 30.
Gold, Swinging riddles, &c.,	Oscar Willis, Morgantown, N. C., Sept. 5.
Do. Washing, &c.,	Thomas Rives, Jr., Hall county, Ga., Feb. 3.
Do. do. do.	William Davis, Fauquier county, Va., Nov. 22.
Grates,	James Alwater, New Haven, Conn., Oct. 25.
Gridirons,	F. Bush & L. Pratt, Meriden, Conn., March 28.
Grinding cylinders,	Jonathan Bridges, Troy, N. Y., July 24.
Grist mill,	Gideon Hotchkiss, Windsor, N. Y., Jan. 27.
Do.	Amos Barnes, Colesville, N. Y., April 27.

Grist mill,	Oliver N. May, Hancock, N. Y., May 5.
Do.	Asahel Bacon, Windsor, N. Y., June 4.
Do.	Joseph C. Gentry, Philadelphia, Pa., July 14.
Do. gate pressure,	Seaver Prentiss, city of N. Y., June 4.
Do. scouring & hulling,	D. Parmelee & J. Moores, New Troy, Pa., June 12.
Hair for matrasses, Picking	A. Green & J. S. Osgood, Hamilton, N. Y., Dec. 18.
Harness, Fly net for horses'	Henry Korn, Philadelphia, Pa., June 22.
Harrow, Corn and grain cultivator	Nathaniel Stanton, Jr., Florida, N. Y., July 9.
Do. Cylindrical revolving	James D. Woodside, Washington, D. C., July 28.
Hat bodies,	Seth Graham, Fayette, Maine, May 15.
Hats, Manufacture of	J. Taylor & C. Brown, Danbury, Conn., Jan. 13.
Do. Napping	J. Dart, Jr., W. Wells & D. Olmsted, Buffalo, N.Y., May 12.
Do. do.	H. Wortham & G. S. Petty, Lancaster, Ky., July 9.
Do. Planking	G. & E. Page, Manchester, Conn., Nov. 9.
Do. Washing	Samuel Drinkhouse, Easton borough, Pa., Jan. 30.
Do. Water-proof	Richard Mills, Baltimore, Md., Feb. 27.
Do. do. Stiffening,	George W. Downs, Circleville, Ohio, Oct. 25.
Heat from smoke, Abstracting	Daniel Steinhaver, Philadelphia, Pa., Dec. 13.
Hoe,	Benjamin Hinkley, Fayette, Me., June 23.
Hoes, Fastening handles to	Reener Dare, Greenwich, N. J., Feb. 14.
Horse power,	T.D. Burrall, & J. F. Axtell, Geneva, N.Y., June 13.
Do.	Timothy Showerman, Covington, N. Y., June 27.
Do. & accelerating motion,	Richard S. Schevenell, Orangeburg, S. C., Nov. 13.
Do. Portable	James H. Corey, Bethel township, Ohio, Feb. 27.
Do. do.	David Flagg, Jr., city of New York, Dec. 28.
Hulling buckwheat, barley,	Thomas Register, West township, Ohio, April 5.
Do. clover seed,	Christopher Seebold, Jr., New Berlin, Pa., March 6.
Do. do.	Geo. Monehon, Augusta township, Ohio, April 27.
Do. do.	Pierson Reading, Trenton, N. J., July 31.
Do. do.	G & E. Faber, Pittsburg, Pa., Oct. 13.
Do. and chopping grain,	G. Wales, Centre township, Union Co., Pa., July 24.
Do. and cleaning grain,	Orin Lull, Otsego, N. Y., Aug. 25.
Do. rice,	Joshua M. Buskey, city of New York, Oct. 25.
Do. do. and barley,	T. F. Strong & M. T. Moody, Northampton, Mass., Nov. 17.
Do. and polishing rice,	J. Beach & S. Starr, Middletown, Conn., May 10.
Do. do. do.	T. F. Strong & M. T. Moody, Northampton, Mass., Aug. 29.
Hydrostatic oil press,	O. Badger & O. Lull, Otsego, N. Y., Aug. 9.
Ice steamboat	Robert Irvin, Baltimore, Md., Jan. 12.
Inclined planes, Propelling cars on	William Bent, Philadelphia, Pa., Oct. 25.
Iron manufacture,	Norman Callender, Reesville, N. Y., July 18.
Iron ore, Separating	Joseph Goulding, Ramapo, N. Y., May 18.
Kiln, Lime	Samuel Griscom, Reading, Pa., June 26.
Lamps, Compound spirits for	William Magee, city of New York, April 27.
Do. Gas	Solomon Andrews, Perth Amboy, N. J., May 10.
Do. tallow, &c.,	Norman Rublee, Montpelier, Vt., Dec. 4.
Lancet, or guard spring,	Samuel Wilmot, Bridgeport, Conn., Oct. 25
Lathe, Turning	William Green, Bedford county, Tenn., April 27.
Do. do.	John Bisbee, Plainfield, Mass., Nov. 8.
Do. do. chair-tops,	Horatio Cook, city of New York, Nov. 30.
Do. do. whip-stocks,	G. Dayton & A. Mallory, Westfield, Mass., April 27
Laths, Cutting	Ira Carpenter, Cincinnati, Ohio, May 2.
Do. do. Revolving	Simon Billard, Cincinnati, Ohio, March 16.
Leg and thigh, Extending	Joseph Merrill, Glasgow, Ky., June 22.
Lightning, Protecting vessels from	Elisha L. Keen, city of New York, June 27.
Lime, Spreading	Mark L. Wilson, Quakertown, Pa., June 22.
Lock, Door	James Kyle, Ramapo, N. Y., May 18.
Do. or spring latch,	Robert J. Byram, Boston, Mass., May 13.
Do. Manufacturing	James Meneely, Watervliet, N. Y., Jan. 12.

Lock, Compression cannon	Joshua Shaw, Philadelphia, Pa., Dec. 3.
Do. Percussion	Israel B. Richardson, Palmyra, N. Y., Feb. 17.
Do. do.	Francis Dowler, Wayne township, Ohio, April 9.
Do. do.	David G. Colburn, Port Byron, N. Y., Oct. 25.
Do. Portable cannon	Joshua Shaw, Philadelphia, Pa., Dec. 3.
Marble, Sawing	Isaac D. Kirk, Philadelphia, Pa., July 3.
Marine railway,	Leonard White, Norfolk, Va., Nov. 15.
Medicine, Anti-spasmodic tincture	Horton Howard, Columbus Ohio, Aug. 30.
Do. Astringent tonic	Do. do. do. do. 25.
Do. Bitter tonic	Do. do. do. do. 25.
Do. Compound tincture myrrh.	Do. do. do. do. 25.
Do. Cure for cholera	Jacob Houck, Baltimore, Md., Aug. 25.
Do. Sweating powders	Horton Howard, Columbus, Ohio, Aug. 25.
Milk, Can for	Artemus Crittenden, West Turin, N. Y., July 14.
Mill stones,	David Stern, Vandenburg county, Ind., Jan. 5.
Do. Annular	John Morley, city of New York, Nov. 28.
Do. Bed	William Bennett, Chesterville, Me., Oct. 25.
Do. Dressing	John Keefer, Williamsport, Pa., Jan. 13.
Mineral water, Seidlitz or Rochelle	Joseph Boston, city of New York, May 5.
Do. Soda apparatus	George H. Duffy, Alexandria. D. C., April 19.
Do. Do.	Joseph H. Lanning, Philadelphia, Pa., June 22.
Do. Soda fountain,	J. Fraley & A. Kirkpatrick, Urban, Ohio, May 9.
Moccasins, socks,	Denison Williams, city of New York, Oct. 24.
Nails, Cutting and heading	Emerald Mason, Milton, Vt., June 6.
Do. Manufacturing	Freeman Palmer, Buffalo, N. Y., Oct. 25.
Do. Wrought	Thomas W. Harvey, Jamestown, N. Y., Jan. 4.
Do. do.	John V. Green, city of New York, Dec. 28.
Oakum, Picking	E. Cook & S. Usher, Haddam, Conn., July 9.
Oil cloth, Manufacture of	D. Powers, Lansingburg, N. Y., Feb. 18.
Oil, Fish, whale and sperm	D. C. & C. H. Knapp & A. Howland, Oswego, N.Y., May 29.
Oil, Whale, sperm, cotton seed, &c.	Ephraim C. Moss, city of New York, Dec. 28.
Opium from poppy, Pressing	Lucius Cook, Shrewsburg, N. H., April 20.
Organs, Seraphina	Louis Zwahlen, city of New York, May 5.
Ovens, Tin bake	William Lewis, Franklin, N. Y., Jan. 6.
Packing for steam engines,	William V. Grinnell, Middletown, Conn., April 5.
Paint, or composition for launching,	Winslow, Chandler & Milliken, Unity, Me., June 4.
Do. mill, grain, &c.,	James Bogardus, city of New York, Jan. 18.
Do. do. indigo	Oliver C. Harris, Waterville, N. Y., March 15.
Do. do. dye stuffs, &c.,	William C. Johnson, Philadelphia, Pa., May 3.
Painting, elastic stamp, &c.,	Thomas Boynton, Windsor, Vt., July 12.
Paper making, Filtering for	Thomas French, Ithaca, N. Y., May 26.
Do. Manufacturing	Solomon Stimpson, Newbury, Vt., March 12.
Do. for covered buildings,	Frederic A. Tuft, Dedham, Mass., May 11.
Do. press, Hot and cold cylinder	A. H. Jarvis & T. French. Ithaca, N. Y., Nov. 6.
Do. Sizing	John Ames, Springfield, Mass., Sept. 1.
Pegs or pins, Pointing	James Hull, North Bridgewater, Mass., July 7.
Picker and spreading cotton,	James Whiten, North Bridge, Mass., July 20.
Pins, Manufacturing	John J. Howe, North Salem, N. Y., June 22.
Pipes, Coating with tin	Thomas Ewbank, city of New York, May 16.
Plane, Double iron	William B. Reynolds, St. Clairsville, Ohio, July 7.
Planing machine	Thomas F. Fuller, Bristol, Pa., Oct. 25.
Do. boards, and polishing marble,	Moses Lancaster, Philadelphia, Pa., April 5.
Do. tongueing & grooving	John Drummond, Whitestown, N. Y., April 27.
Do. wood, horizontal knife	Uri Emmons, city of New York, March 6.
Pliers, Cutting	Russel Curtis, Springfield, Mass., Oct. 25.
Plough,	Thomas Whities, Bellefontaine, Ohio, Jan. 14.

Plough,	Samuel Ogle, Adams county, Pa., Feb. 28.
Do.	Joseph Dudley, Fleming county, Ky., May 8.
Do.	George Crowl, Sleepy creek, Va., June 27.
Do.	George Wolf, Fairfield county, Ohio, June 27.
Do.	John Moore, Cynthiana, Ky., Aug. 7.
Do.	Geo. W. Palmer, Jefferson township, Ohio, Aug. 17
Do.	John Weaver, Brownsville, Pa., Aug. 17.
Do.	John Bucks, East Rushville, Ohio, Dec. 28.
Do. Bar share	Moses Huffman, Elizabeth, Tennessee, Dec. 28.
Do. and harrow,	Henry Highly, Canaan, Conn., Dec. 11.
Do. Self-sharpening	Bancroft Woodcock, Mt. Pleasant, Pa., Jan. 26.
Do. do.	Job B. Norton, Utica, N. Y., April 27.
Do. do.	Waldren Beach, Philadelphia, Pa., Dec. 28.
Plugs for ships, Cutting	Daniel Flint, Nobleborough, Maine, April 19.
Power. Propelling mills by lever	William Rhodes, Trenton, Tenn., April 27.
Press, Cheese	Benjamin Hinkley, Fayette, Me., Oct. 25.
Do. do. cider, &c.,	John Holmes, Paris, Me., Feb. 6.
Do. Cotton	David Phillips, Natchez, Miss., April 27.
Do. Flour	Sylvanus Hathaway, Massillon, Ohio, Feb. 13.
Do. Rotary toggle-joint	Thomas W. Harvey, Jamestown, N. Y., April 27.
Do. Standing	Aaron Hale, Boston, Mass., June 26.
Do. Tobacco	George Booker, Richmond, Va , Feb. 8.
Do. Wedge	Oliver Perkins, Oxford, Me., Aug. 8.
Printing machines,	John Hatch. Boston, Mass., March 21.
Do. press, Faustus	Seth Adams, Boston, Mass.. May 23.
Propelling boats,	Jarvis Ring, Ogden, N. Y.. Oct. 25.
Do. canal steamboats,	I. Sheffield & I. Ingraham, Erie county, N. Y., May 17.
Pulp dresser,	Coleman Sellers, Philadelphia, Pa., June 6.
Do. Preparing and dressing	John Ames, Springfield, Mass. Sept. 1.
Do. strainer,	James Sawyer, Newbury, Vt., Jan. 21.
Pumps,	Moses Bucklin, Grafton, N. H., Oct. 25.
Do. Air, or ventilator	G. Harly & I. Sedgwick, Philadelphia, Pa., June 1.
Do. Spiral	Cotton Foss, Perry, Ohio, Aug. 4.
Do. Valve spring, or drop	Eli Kendells Ashby, Mass , June 22.
Punching holes in raw hides,	William Angell. Providence. R. I., July 19.
Do. Iron, steel, &c.,	James Bennett, Brutus, N. Y., July 25.
Rags, Cleaning	George Curriel, Manchester, Conn., Feb. 7.
Do. do. and dusting	Samuel E. Foster, Brattleborough, Vt., June 1.
Railroad cars,	Jedediah Richards, Elbridge, N. Y., March 9.
Do. switches,	William Howard, Baltimore, Md., Aug. 2.
Raising water,	L. Disbrow & I. Sullivan, city of New York, Aug. 28.
Do. do.	Philip Tusing, Broek's Gap, Va., Nov. 7.
Do. do. by steam,	David Colver, Deer Creek, Ohio, June 6.
Rifles, Cane	Roger N. Lambert, Upton, Mass., Feb 27.
Do. Manufacture of	J. W. Plummer & J. Clark, Wayne township, Ohio, May 17.
Rivets for copper,	George W. Sowle, New Bedford, Mass., May 11.
Ruler, Parallel	James Carrington, Wallingford, Conn., April 14.
Ruling paper,	Alfred Hathaway, Troy, Mass., Dec. 31.
Saddles, Steel spring, worm	George Pritchard. Clarkburg, Va., May 3.
Do. trees, Harness	Philo Washburn, Taunton, Mass.. March 8.
Salt, Manufacturing	Calvin Guiteau, Geddes, N. Y., Oct. 25.
Saw, Gumming	Jeremiah Case, Sodus, N. Y., Oct. 25.
Do. Manufacturing	Stephen Ustick, Washington, D. C., Aug. 11.
Do. Set, for mills,	Norman Urquhart, Madison county, Ala. Feb. 7.
Do. for cutting Laths, Circular	Francis Shumard, Cincinnati, Ohio, Oct. 31.
Do. strainer,	T. V. Leroy. & A. Sanford, Newport, N. Y., July 25.
Do. mills,	Vachael Blayloch, Bellefontaine, Ohio, March 24.
Do. do.	John R. Drake, Oswego N. Y., April 27.
Do. do.	Levi Chapin, Walpole, N H., June 1.
Do. do.	David W. Hall, Sparta, Geo , Nov. 27.
Do. do. Blockhead for	John Sinclair, Richland, Ohio, Feb. 28.

Saw mill, circular railway, &c.,	Allen B. Reynolds, Cincinnati, Ohio, June 29.
Sawing circles,	Thomas Armstrong, Hamilton county, Ohio, July 18.
Do. wood,	T .Blood & S. A. Hurd, Fairfield county, Conn., May 22.
Screws, Cutting endless	John H. Shrader, Philadelphia, Pa. Oct. 25.
Shell and shot, Elongated spiral	W. P. Pier & A. Mack, Detroit, Mich. April 6.
Shingles, Cutting	George Wolf, Clearcreek township, Ohio, March 22.
Do. Sawing	D. McArthur & T. McKibbin, Urbano, Ohio, Feb. 15.
Do. & staves, heading, &c.,	David Flagg, Jr., city of New York, Dec 28.
Shot, Manufacturing buck	John Snyder, city of New York, Jan. 26.
Silk reel,	Eliphalet Snow, Mansfield, Conn. March 16.
Do. do.	Charles G. Green, Windsor, Ver., May 31.
Smoke ventilator,	Silas Smith, Hamilton, Ohio, March 17.
Smut machine,	Stephen Fellows, Sandwich, N. H., May 24.
Do. do.	Nathaniel Winslow, Poughkeepsie, N. Y., Oct. 26.
Spade, Socket	C. Richmond & H. Caswell, Jr., Taunton, Mass., July 13.
Spinning, Roping cotton	John A. Bradshaw, Foxborough, Mass., Dec. 8.
Do. Spindle cotton	Nathaniel Rider, Dudley, Mass., Nov. 3.
Do. throstle frame	Seth Simmons, Providence, R. I., Jan. 16.
Do. Wool	Calvert, Southwick, & Messenger, Lowell, Mass., March 31.
Do. do. and cotton	David Newbrough, Ridley township, Ohio, April 27.
Spools and bobbins	Simeon Prestrey, Jr., Canton, Mass., July 26.
Spoons, Manufacturing	Charles Goodyear, Philadelphia, Pa., Aug. 11.
Stairs, Circular, &c.	Edward B. Smith, Buffalo, N. Y., Nov. 15.
Staves, jointing, &c.,	Philip Cornell, Brutus, N. Y., April 11.
Steam engine,	Stacy Costill, Philadelphia, Pa., Feb. 20
Do. do.	Lafayette Tibbitts, New Glasgow, Va., June 22.
Do. do. locomotive, & cars,	S. H. Long, Philadelphia, Pa., Dec. 28.
Do. do. Rotary	Luther Carman, Oxford, Me. July 16.
Do. do. do.	William Jones, Bradford Va., Nov. 10.
Do. to machinery, Applying	Seth Boyden, Newark, N. J., Oct. 31.
Do. Generating & applying	Benjamin Phillips, Philadelphia, Pa., Jan. 31.
Do. power, Increasing	N. P. Goodell, Kirtland, Ohio, Jan. 23.
Steering ships, &c.,	Elijah Soule, Duxbury, Mass., Nov. 3.
Stereotype blocks,	Samuel Sawyer, Boston, Mass., May 28.
Do. do.	Bradbury Haskett, Boston, Mass , May 21.
Do. do. Fastening cam and spring	Abel Chandler, Concord, Mass., July 13.
Stock,	Edmund Badger, Philadelphia, Pa., April 5.
Do. Gin sawing	Abraham Myers, Boonsborough, Mass., Nov. 9.
Stone, &c., Dressing	Clark Miller, Williamsport, Pa., Feb. 14.
Stoves	Nathan Parrish, Mendon, N. Y., Nov. 2.
Do. Anthracite coal	Jordan L. Mott, City of New York, May 30.
Do. do.	Eliphalet Nott, Schenectady N. Y., Oct. 25.
Do. and chimney's construction.	Asa Graham, Rumford, Me. Dec 28.
Do. and furnaces.	Ephraim Baldwin, Gibbonsville, N. Y., July 19.
Straw, hay, &c., Cutting	Jacob Harland, Tompkinsville, Ky., April 19.
Do. and Leghorn Bonnets, Pressing	Otis Plimpton, Foxborough, Mass,, Dec. 28.
Stumps of trees, Removing	John E. Larkin, Salem, N. Y., Oct. 25.
Syphilis, medicine for the cure of	Nicholas Badeau, city of New York, March 8.
Tan vats, or letches,	William Brown, Herkimer, N. Y., June 28.
Tanning hides, liming, &c ,	Caleb Hawk, Monroe county, Va. May 3.
Do. leather,	Joseph Blunt, city of New York, Nov. 30.
Do. Preparing hides for	Lewis Newsom, Gallipolis, Ohio, March 8.
Do. without use of lime,	Edward Evans, Salem township, Pa. Dec. 28.
Tenons, Sawing	Charles Thompson, Poughkeepsie, N. Y., Dec. 6.

Threshing machine,	Orlando Hurd, Bridgeport, Conn., Jan. 23.
Do. do.	Nathaniel Adams, Westmoreland, N. Y., March 2.
Do. do.	Hardin Branch, city of New York, April 18.
Do. do.	Samuel Cable, Beaver Creek township, Ohio, May 10.
Do. do.	M. S. Flaglor, city of New York, July 7.
Do. do.	Squire Campbell, Onandaga, N. Y., Oct. 26.
Do. do. and grist mill,	Matthew Wilson, Springfield, Va. April 18.
Do. and shelling corn and grinding apples,	Jesse Bevier, Sempronius, N. Y. Dec. 11.
Tide and current mills,	James Bennet, Vigo county, Ind., Aug. 10.
Tin kitchen,	George Richardson, South Reading, Mass., June 14.
Tobacco segar fillers, Preparing	Joseph Maffet, Lancaster, Pa., May 16.
Tonsillarum sector,	Wm. B. Fahnestock, Lancaster, Pa. May 25.
Tools, Holding and grinding	George A. Medeira, Chambersburg, Pa., April 19.
Truss for vessels,	Jonathan T. Quimby, Belfast, Me., Jan 30.
Valve, Face plate	Stacy Costill, Philadelphia, Pa.. April 13.
Do. Safety piston	John C. Douglass, city of New York, Jan. 30.
Do. Sliding	Thomas Halloway, Philadelphia, Pa., Jan. 20
Do. for vibrating steam engine,	Do. do. do. 20.
Do. Wing gudgeon	Do. do. do. 20.
Varnish to whipstaffs, Applying	Frederick Morgan, Westfield, Mass., April 27.
Ventilating machine,	G. Harley & J. Sedgwick, Philadelphia, Pa. June 1.
Do. vessels, &c.,	Jesse Remington, Baltimore, Md., March 1.
Visors for caps, Cutting leather	Jacob Hawkins, Roxbury, Mass., Feb. 20.
Warming rooms, &c.,	Robert B. Varden, Baltimore, Md., Feb. 6.
Washing machine,	Silvanus Hathaway, Massillon, Ohio, Feb. 13.
Do. do.	McAll, Higgins, & Rogers, Athens, Ohio, Feb. 15.
Do. do.	D. G. Wilson, Machias, Me., April 6.
Do. do.	Simeon Savage, E. Machias, Me., April 11.
Do. do.	Sylvanus Menton, Pendleton, S C., April 14.
Do. do.	Benton P. Coston, Philadelphia, Pa. April 27.
Do. do.	I. S. E. Pulsifer, Ipswich, Mass., May 21.
Do. do.	Ezra Fisk, Fayette, Me., May 25.
Do. do.	Ebenezer Mayo, Hallowell, Me., May 26.
Do. do.	Ira Avery, Springfield, Pa., June 22.
Do. do.	N. Howe & J. McCollam, New Petersburg, Ohio, June 30.
Do. do.	Isaac S. Wright, Weedsport, N. Y., July 18.
Do. do.	W. W. Woodburn, Greensburg, N. C., Juy 18.
Do. do.	W. H. Cummings, Guilford, N. C , Nov. 3.
Do. do.	Eli Nicholls. Union township, Ohio, Nov. 24.
Do. do.	Jacob Lindsay, Canajoharie, N. Y., Dec. 28.
Do. do. and drying	Thomas Pearce, Hartwick, N. Y., Dec. 29.
Do do. and scouring	N. Morrison & J. Lewis, Uniontown. Pa ,March 14.
Do. do. do.	Camm Moore, Guilford county, N. C., Oct. 30.
Water, Supplying houses with	William Bryant, Davidson county, Tenn., Oct. 25.
Do. Power to a number of wheels,	Henry Crenshaw, Anderson district, S. C., Dec. 28.
Do. wheel,	James McConnel, Shenango, Pa., Dec. 13.
Do. do.	John Moffit, Richmond, Ohio, April 17.
Do. do. Chain action	Sandford Reynolds, Pitcher, N. Y., Dec. 15.
Do. do. do. paddles,	Davidson Myers, Benton, Mo., Sep. 4.
Do. do. folding ladle boards	Thomas Winslow, Jay, Me., Oct. 25.
Do. do. Horizontal	Sheldon Stoddards, Jackson township, Pa., May 28.
Do. do. do.	Asahel Baron, Windsor, N. Y., June 4.
Do. do. do.	J. Nuchols & S. P. Wheeler, Bolivar, Tenn, June 22.
Do. do. Inclined	Cotton Foss, Perry, Ohio, Aug. 4.

Water wheel, Reacting	G. W. Henderson, & J. Russel, Milburn, Me., Sep. 22.
Do. do. do.	Gideon Hotchkiss, Windsor, N. Y., Nov. 6.
Do. do. and sawmill,	Charles Forse, Booneville, Miss., Aug. 24.
Wheels and axles of locomotives, &c.,	Richard Berrian, city of New York, Nov. 13.
Do. boxes, Setting	Josiah Chancy, Chesterville, Me., Oct. 25.
Do. do. hubs, &c.,	David Watson, Fayette, Mass., May 29.
Do. Drilling & boring car	Dean Walker, Gunpowder, Md., Dec. 28.
Do. Bending felloes of	Tristram Kimball, Salem, N. H., Jan. 16.
Do. hubs, Cast iron	John Thurston, Providence, R. I. Dec. 3.
Do. do. Cutting and boring	John B. Francis, Loudon county, Va., March 2.
Do. Cutting tenons on spokes of	James Smith, Fayette, Me. June 7.
Winch and gin for loading vessels	Eleazer Allen, city of New York, Feb. 29.
Wind wheel for propelling boats &c.,	Benjamin Dugdale, Trenton, N. J., May 3.
Do. do. or water,	Adkins Nash, Addison, Me., April 27.
Do. do. Horizontal	Jeremiah L. Coleman, Vincennes, Ind., May 4.
Window sash,	Charles Thompson, Poughkeepsie, N. Y., Dec. 6.
Wine from cider,	Jacob Hugus, Hempfield, Pa., Oct. 1.
Winnowing clover seed,	George Faber, Chambersburg, Pa., April 5.
Do. grain, &c.,	A. Look & W. Coleman, Jr., Fredericktown, Md., March 21.
Do. machine, fanning mill,	Samuel Fitch, Edmeston, N. Y., Jan. 6.
Do do. do.	P. Prine & L. Huestis, Auburn, N. Y., Feb. 23.
Do. do. do.	David Clinton, New Haven, Conn., Nov. 22.
Do. do. do.	Hunter, Hunt, & Holman, Oakland county, Mich., Dec. 18.
Do. mill machinery,	James Ruple, Washington, Pa., May 19.
Do. do. do.	Daniel Davis, Cornish, N. H., July 5.
Wrench, rack	Henry King, Springfield, Mass., Oct. 25.
Yarn, Dressing preparatory to weaving	Samuel Batchelder, Saco, Me., June 22.

BIBLIOGRAPHICAL NOTICES.

Gillespie on Road Making.

"A Manual of the Principles and Practice of Road Making: comprising the location, construction, and improvement of Roads (common, Macadam, paved, plank, &c.,) and Railroads. By W. M. Gillespie, A. M. C. E., Professor of Civil Engineering in Union College, New York. Published by A. S. Barnes & Co., 1847."

This small volume contains much valuable matter, derived from the best authorities, and set forth in a clear and simple style. The subject upon which it treats is one of great importance, and it would be a useful book in the hands of all persons employed in laying out roads, and especially common roads in our country. For the want of information which is contained in this manual, serious mistakes are frequently made, and roads are badly located and badly constructed by persons ignorant of the true principles which ought to govern in such cases. That branch of civil engineering which relates to the improvement of common roads has been much neglected in our country, and the care of them has been very generally entrusted to incompetent hands; but, by the extensive circulation of such books as that now before us, and the imparting of sound views on the subject to the students of our collegiate institutions, we may hope for a change for the better in this respect. The number of persons competent to do the work well will be increased, and the conviction will become general that no one ought to be entrusted with the laying out or constructing of a road, unless he has first studied the subject and made himself fit for the duty which he undertakes to perform.

Morfit on Perfumery—its Manufacture, Use, &c., &c.

Perfumery,—its Manufacture and Use, &c., &c.: from the French of Clenart, and other late authorities; with additions and improvements. By Campbell Morfit, Esq.

This is a neat manual of perfumery, and contains many processes and recipes which will be of use to those who interest themselves with that art and its products. The explanations are clear, and the matter of the work is as creditable to the compiler as the manner in which it is got up is to the publishers, (Messrs. Carey & Hart.) It, however, would be much improved by the addition of an index. We regret to see that the style occasionally shows marks of carelessness and of inexcusable haste; thus, (page 14,) it is stated that "the sale of an article is *in a ratio proportional to the price;*" and, (page 254.) "the flotant soaps" (why not use the English term, *floating soaps?*) "owe their title to the mechanical operation by which their *weight is lessened one-half, without a corresponding diminution of bulk.*" The constant affectation of French terms renders the style flippant, and produces an impression unfavorable to the author. A technical author cannot be expected to write elegantly, but there is every reason why he should be more than usually careful to write correctly. Again, when a quotation from the scriptures is necessary, the authorized version should, except under very peculiar circumstances, be adhered to, and great care should be taken to have the passage literally correct. This has not been done in the passages cited in the preface of this work, and in the second case, (Exod. xxx, 34–35,) the use of the word *confection* as a verb is at once a departure from the authorized version of the scriptures, and the authorized rules of the language.

We have been more particular in noticing these defects, as we understand that the young and promising author is engaged in another and more original work upon an important branch of technology, and we should be glad to find that, by a little attention to matters of this kind, which are, we are sorry to say, generally too much neglected, he has added purity of style to his excellent knowledge of his subject, and thus rendered his work creditable to himself and his country.

F.

FRANKLIN INSTITUTE.

Demonstrations by means of Models.

At the monthly meeting of the Franklin Institute, held May 20th, 1847, the following statements and computations relative to Mr. Herron's model of a railroad bridge, which the inventor then exhibited, were made by *Prof. W. R. Johnson:*

Mr. Herron had stated that his bridge was intended to have a clear opening of one hundred and fifty feet, a height of sixteen, and a breadth of twenty-two feet, and to bear a load equivalent to two trains of twenty-ton locomotives placed close together throughout its length, and which he supposed would be equivalent to two tons per *foot of length* of the structure. He also stated that the model was constructed on the scale of one inch to a foot, and that the proportion of parts had been preserved throughout. The model had been weighed just before the meeting, and 150 inches of its length were found to weigh 136·3 pounds. He also mentioned that it had been subjected for many hours to a weight of 3080 pounds distributed over its length, and to more than 1700 pounds accumulated near the centre. This latter load had been accompanied by rather violent motions, on the model, of a part of the load, consisting of the weight of two or three heavy persons, who, by rising a short distance and then coming down with nearly their whole weight, were able to communicate shocks more than proportional to those which the large structure could receive from the passage of trains.

Prof. Johnson observed, at the commencement of his remarks, that the plan of solving questions in practical mechanics and engineering by faithfully constructed models, presented the very obvious advantage of substituting the moderate cost of *experiment* for the often burthensome, sometimes ruinous, expense of *experience*. This method has wisely been adopted by the engineer entrusted with the building of a railroad bridge over the celebrated Menai Strait; and the liberal expenditure understood to have been made under the control of Messrs. Fairbairn and Hodgkinson, to prove experimentally the value of different plans of construction for rigid iron bridges, proves the estimation in which this method of solving practical questions is held among the engineers and practical mechanics of Great Britain.

The conditions to be fulfilled in constructing *models* so as to give reliable information in regard to the action or the stability of *structures*, were stated as follows:—

1. An entire correspondence in the *model*, at least of all *essential parts*, to the *scale* of dimensions and weights on which it is proposed to represent the *structure*.

2. Identity not only in the nature, but also in the condition, of materials employed in the model and structure respectively.

3. Proportional accuracy in forming junctures; and proportional tensions given by tightening-screws, keys, wedges, and other mechanical means by which the parts are compacted together.

In testing the model, modes of introducing, distributing, and withdrawing the loads, conformable to those which practice will involve in regard to the structure, must be observed, so as to subject the model to shocks, jars, inequality of pressure, and irregularities of application, at least proportional to those which the structure will be required to sustain.

Supposing the model to have been constructed according to the above requirements, it might be used for either of the two following purposes:—

1. *To determine what weight the structure will bear when undergoing a given deflection, or when on the point of breaking.*
2. *To ascertain whether the principle of construction adopted by the inventor, be adequate to furnish a bridge of the proposed dimensions and materials that can fulfil the specified duty.*

The latter problem is the one more particularly intended to be solved by the use of the model in question.

As a beam or bridge of uniform dimensions throughout will bear half as much weight accumulated at the centre as it could sustain if distributed throughout its length; the simplest mode of arriving at the result desired, is to determine and apply to the centre of the model a weight which shall represent one half the load supposed to come upon the structure.

The following formula, essentially similar to that of Gregory, applies to the loading of the model at its centre:

Let l=the length of the model in feet, between the points of support. $(=12^3.)$
w=the weight of so much of it as lies over the clear opening between the piers.
p=the weight in pounds which it is to sustain at the centre, when bearing a load, representing the two trains of heavy locomotives.
r=the ratio of dimensions between the *structure* and the *model.* $(=12:1.)$
P=the *load* which the structure must be able to bear accumulated at the centre (=150 tons.)

Then it is evident that $r\,l$=the length of structure between the piers. (=150 feet.)

And since the relative resisting powers of similar beams or bridges are as the second powers of their corresponding dimensions, $\therefore r^2:1=$ the relative resisting powers of the *model* and *structure.*

Hence, $r^2\,(p+\frac{1}{2}w)$=the absolute resisting power of the *structure.*

Also, since the *weights* of similar structures are as the third powers of their corresponding dimensions, or, what is the same thing, as the third powers of their *ratios of dimension*, therefore, $r^3\,w$=the absolute weight of the *structure;* so that the weight P, which, by supposition, the structure can bear, accumulated at its centre, will be its absolute resisting power, diminished by half its own weight.

Hence, $$P=r^2\left(p+\frac{w}{2}\right)-\frac{r^3\,w}{2}=r^2\,p-\frac{r^3\,w+r^2 w}{2}=r^2\,p-r^2(r-1)\frac{w}{2}=r^2\left(p-\frac{w}{2}\times\overline{r-1}\right).$$

But as, by supposition, P is known, and it is desired to find p, the conversion of the last formula gives $p=\frac{P}{r^{2}}+\frac{w}{2}\left(r-1.\right)$

In order to determine whether any, and, if any, what class of locomotives could, if composing two entire trains, load a bridge with a weight of two tons per foot of length, Prof. J. presented the following table, derived from information received from Mr. Baldwin's factory, as to the weights and lengths of the several classes of engines, including the *bumpers*:—

Class.	Weight of engine in tons, including water.	Number of wheels.	Length of engine in feet.	Tons weight of locomotives on 300 feet of single track.	Tons on each foot of bridge when loaded with two trains of locomotives.
1	25	8	24	312	2·08
2	20	6	22	272	1·81
3	20	8	23⅞	251	1·68
4	17	6	21	243	1·62
5	18	6	22½	240	1·60
6	15	6 or 8	21	214	1·43
7	12	6	19½	185	1·23

From this it appears that no class of engines, except that of 25 tons in weight, could possibly load the bridge with so much as 300 tons. Twelve engines of that class placed on the bridge, about fourteen inches apart, *would* form the load assumed by Mr. Herron. To compute the load on the centre of the *model* which shall represent this load on the structure, we substitute the values of the several symbols in the equation $p=\frac{P}{r^{2}}+\frac{w}{2}\left(r-1\right)$, and obtain

$$p=\frac{300\times 2240}{144}+\frac{136{\cdot}3}{2}\times(12-1)=3082 \text{ pounds.}$$

Twice this sum, or 6164 pounds, is the weight which the model ought to bear distributed over its length, or about double the load yet put upon it.

The bridge of Mr. Herron is to be composed of stringers, cross ties, braces, and uprights of *wood;* and diagonal braces both in the horizontal and vertical planes, formed of *iron* screw bolts. In this latter particular the model does not fulfil the second of the above conditions. It wants identity of condition in the materials. Iron in the state of unannealed *wires* is used instead of rolled or hammered *bolts.*

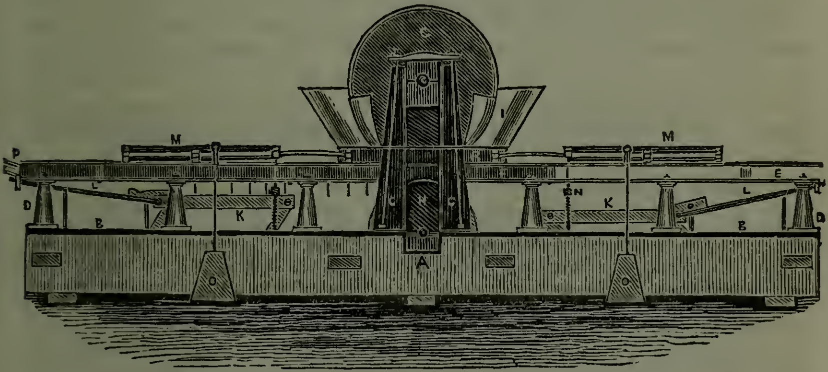
By reference to the Report of the Committee of the Franklin Institute on the strength of materials for steam boilers, pages 158 and 244, it is found that good iron *wire* possesses a strength of 81,000 pounds per square inch; while at pages 152—157, it appears that good bolt iron possesses, in its ordinary state, a strength of about 60,000 pounds per square inch. Hence the relative resisting power of the model, so far as it depends on its iron braces, is $\frac{7}{20}$ greater than that of the structure will be.

Committee on Science and the Arts.

Report on Culbertson's Brick Press.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination a Dry Clay Brick Press, invented by Mr. T. Culbertson, of Cincinnati, Ohio, Report:—

That Mr. Culbertson exhibited, at the hall of the Institute, a beautiful model of his machine, which combines, in an eminent degree, the merits of simplicity, ingenuity, and utility. He also furnished the following drawing and explanations, which clearly illustrate its construction:



In the above wood cut, A represents the sills upon which the machine rests; B, cast iron bed plates, resting upon, and bolted to, the sills; C, C, posts which sustain the press wheel G; D, D, posts upon which the slides E rest, and through which they are strongly bolted to the bed plates; F, carriage containing fourteen moulds, each of which is provided with a movable bottom, or follower, which rests upon the bottom plate of the carriage. To each of these followers two stems are attached, which project through the bottom plate. The carriage is guided in its movements by embracing the four slides E, and receives the reciprocating motion from a crank, or other mechanical equivalent movement, by means of a connecting rod, or pitman, P. The extent of the motion to the carriage is such, that the whole set of moulds pass under the press wheel G each way, thus equalizing the density of the brick. The press wheel G, is placed vertically over the bearing roller H, and above the moulds—its journals turn in boxes, which are strongly secured between the vertical posts C, C. H is a friction or bearing roller, upon the periphery of which the mould carriage rests, and is sustained under the pressure necessary to force the clay into the mould; I, hoppers, into which the clay is thrown; R, clay-box, upon which the hoppers rest, and in which the press wheel works. This clay-box is made fast to the posts C, C, its lower edges being as near to the face of the moulds as possible, so as not to rest upon them. In each end of this clay-box a knife is placed ranging with the face of the moulds, so as to shove off all the surplus clay; K, K, parallel levers, to which are attached rods L, L, upon the ends of which nuts or washers are placed in such position as to be struck by, and carried forward and up with, the carriage, as seen on the left. Thus raising the brick out of this end or half of the moulds by the horizontal movement of these levers corresponding with that of the carriage, all tendency to cant the followers, strain or bind the stems, is avoided. As soon as the bricks have been carried up above the upper surface of the moulds, a projection on the side of the carriage comes in contact with, and moves an arm on, the vertical rocking shaft N, which has another arm that gives a lateral movement to the parallel levers M, by which the bricks are shoved off the carriage on a table. The bars M are brought back to their original position by the weights O, O.

Various efforts have been made, for a number of years, in this and other countries, to apply machinery to the manufacture of bricks, for the purpose not only of economizing time and labor in the process, but of securing an exactness in shape not attainable in moulding by hand. In these experiments the practicability of making bricks by compressing clay in its natural state, has been fully tested.

When composed of suitable material, bricks made in this way have been subject to various tests, and have proved to be fully equal to those made in the ordinary manner. In the numerous machines invented for this purpose, practical difficulties have arisen which have not hitherto been entirely overcome. But this machine is simple in its construction, has few wearing surfaces, is not very expensive, requires comparatively little power to drive it, and needs but few hands to attend it. It is self-feeding and self-delivering; it is constructed to make from 2500 to 3000 bricks per hour, it requires no preparation of the clay, and no yard room for drying, as the bricks are sufficiently hard when they come from the press to stack up in the kiln; they are also of a uniform size, and are harder, smoother, and, being less porous, will absorb less water than ordinary brick. The pressure being gradual and continuous, the air is permitted to escape freely as the clay is forced into the moulds. Also, as each mould passes twice under the cylinder, first in one, and then in the opposite direction, and receives clay from the hoppers each way, it (the mould) is pressed full in all the corners and edges, and the different particles of clay are, by this rolling or kneading process, thoroughly united.

By a slight alteration of the moulds, bricks of any desired shape, or size, (suitable for paving, lining cisterns, building arches, &c.,) may be formed. The machines are so constructed that they can be taken to pieces and put together with great facility, thus rendering them portable. As the works will all be under cover, bricks can be made as well in wet as in dry weather; they can also be made later in the fall and earlier in the spring than by the ordinary process, the dry brick being less subject to the action of frost. As they require no drying, but are carried from the platforms directly to the kiln, the expense and liability to accident from being twice handled, and the injury from exposure to rain, are avoided.

The committee also examined two burnt bricks made by this machine, which, on breaking, they found were very strong, compact, and thoroughly burnt.

The committee are of opinion that the machine is a highly valuable invention, and that it is destined to introduce an entire revolution in the process of manufacturing bricks heretofore adopted.

It is proper to state that although the patent of Mr. Culbertson is only for certain improvements on a prior machine, invented and patented by Mr. Parson Owens, he has become the proprietor of both patents, and, therefore, as it is a matter of no concern to the public, the committee have not thought it necessary to specify what parts of the machine were the invention of each of the original patentees.

By order of the Committee,

William Hamilton, Actuary.

Philadelphia, June 10, 1847.

MECHANICS, PHYSICS, AND CHEMISTRY.

An Account of the Construction of the New Lighthouse at the Port of Havana. By Senor Don Jose Benites, Colonel of Royal Engineers.

Translated from the Spanish, for the Journal of the Franklin Institute.

The improvement of the light at the Moro castle, which serves as a guide to vessels entering the port of Havana, in such manner as to correspond not only with the importance of its commerce, but also with the perfection to which the construction of this kind of apparatus has now attained, having been determined upon by the Royal Junta of protection, the department of the Marine was naturally consulted with regard to the most eligible situation and the proper altitude of the new light.

That illustrious body was of opinion that a light placed at the same entrance to the port as the former one, would be preferable to a light elsewhere, although it might be situated on a more elevated point of the coast, owing to the particular configuration of which, it might be seen from further to the windward. With regard to the height, it was judged sufficient to give an additional elevation of 25 feet to the old tower, because the light, being thus placed at 142 feet* above the level of the sea, would overlook the point called Del Pajonal, which bears about N. 71° E., and might, therefore, be readily distinguished and recognized by vessels approaching the port from that direction, within not less than eight nor more than fifteen miles of the coast, and affording still greater advantages to those standing in more from the northward. And, moreover, that with the proposed elevation, this lighthouse would be one of the highest which are known.

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* The Spanish *foot* here used is equal to 11·1 inches, and the *vara*, or yard, is 33·3 inches.

In accordance with this report, the Junta determined, on the 22nd of April, 1840, to proceed with the execution of the work, and its President, the Most Excellent Captain General, directed that the corps of engineers should make the proper examination, in order to ascertain the practicability of giving to the old tower the desired additional elevation. By a report of the commandant, June 2, 1840, it was declared practicable to add the proposed 25 feet to the height of the tower, provided the work were carefully done, and with materials of the best kind.

In this state the project rested until the 16th of October, 1843, when the Junta, through its President, asked that the funds necessary for the work should be remitted; inasmuch as it would also be necessary, in addition to the projected increase in the height of the tower, to order from Paris a lenticular lantern of the most improved kind, by Fresnel, to be placed therein. The requisite funds having been provided, it was resolved, on the 7th of April, 1844, to proceed with the work, but with the indispensable condition that the light should not be interrupted for a single night. Accordingly, the construction of a small temporary tower was commenced on the 22nd of May, for the purpose of sustaining the light while the height of the old tower was being increased by additional mason work. The great height of the platform upon which the temporary tower was constructed, rendered it unnecessary to give it an elevation of more than seven yards, in order to maintain the light at the same height as that at which it was placed in the old tower. Its immediate proximity to this, and the removal of the light to the temporary tower in a single day, rendered it unnecessary to give that notice in the public papers which would otherwise have been requisite in order to avoid dangerous consequences to vessels. On the 23rd of July, 1844, the temporary lighthouse was first put into use; its cost, including the lantern, amounting to the sum of $1800. Its strength, and the judicious principles upon which it was constructed, were fully proved in the terrible hurricane of the 5th of October last; during which, though exposed, without the least protection from other buildings, to the force of the wind and the beating of the waves, it remained firm, and without other injury than a total destruction of the glass in the lantern.

The next step was the taking down of the lantern from the old tower, and to proceed with other preparations for increasing its height, when, on the 14th of August, 1844, notice was received by the board of engineers, from his Excellency, the Captain General, that, by a resolution of the Junta, adopted in virtue of a report from their commissioners, it was determined to suspend the work, and inquire whether it would not be more expedient, provided the funds were sufficient, to construct a tower upon a new plan, which should combine all the beauty, convenience, and facility which would be required for the proper management of an apparatus so complicated as that of Fresnel; advantages which could not be afforded by the old tower, on account of its limited dimensions, and its total want of accommodations for the persons entrusted with the care of the light during the night, as well as its narrow and inconvenient stairway. The board of engineers, as was to be expected, reported in favor of the new project, and at the same time submitted a plan and an estimate for the new tower. Both of these were approved by the Junta at its session on the 16th of August, and the work was ordered to be carried into effect. On the following day, the demolition of the old tower was commenced, and, at the same time, the excavation of a foundation for the new one was begun, in order that the old materials might be used in it.

Situation of the New Tower.—Of the rock upon which the Moro castle is built, that point which extends furthest towards the N. W., and on which the old tower stood, is divided from the rest by a cleft, or fissure, and is also undermined by a large cavern, washed out by the continual beating of the waves. In order to avoid these defects, which might, in time, endanger the stability of the new edifice,—and also because the space afforded for the ground plan was not sufficient, a place was chosen 84 feet further back than the position occupied by the old tower, and on the broadest part of the glacis of the Morillo, a position combining all the advantages of the former one, besides leaving free the extreme point of the Morillo, for the erection of a battery of three Paixhan guns, of large calibre, in such a very advantageous position. Care was also taken to leave sufficient space about the new tower for the free use and management of the cannon which defend the entrance to the port, as well as of those on the opposite side.

Description of the Tower.—It is composed of two parts; the first representing a column 79 feet high, 25 feet in diameter at the base, and 20 at the top. The cornice of this serves as the floor of a corridor with a circular parapet, enclosed by a grated railing of copper, which surrounds the upper, or second part, upon which the lantern is supported. The first, or lower part, is constructed of hewn stone; the wall being seven feet thick at the base; vertical in the interior, and sloping on the outside, 30 inches in the whole height. The interior space of 11 feet in diameter serves for a circular staircase, the steps of which are four feet long, 7½ inches high, 19 inches broad at the wide end, and six at the other, or immediately at the spindle, or central column of three feet in diameter, which extends up through the whole height. The stairway begins inside, at 38 inches in the clear from the door, in order to leave an open landing place; the steps being covered with slabs of marble 1½ inches in thickness, with a moulding which extends an inch beyond the step. The doorway in the lower part of the tower, which gives entrance to the stairway, is four feet wide and eight feet high, with pilasters at the sides; and its cornice and frontispiece in the form of a circular arch. Over the door is a block of marble containing an inscription in Spanish of the following purport:—

In the year 1844:
Isabella the Second reigning;
The Junta of Protection under the Presidency of
the Captain General of the Island, Don Leopold O'Donnell;
This work was executed under the direction of
the Corps of Engineers of the Army.

The stairway is lighted and ventilated by three sets of windows, placed equi-distant from one another throughout the whole height. They are four feet high and two feet wide, and in six of them, the lower part of the niche, or recess in the wall, which forms the window, is level with the steps, and serves as a landing, or resting-place. Below the stairway, and at the level of the lower floor of the tower, is a spacious room, enclosed by a wooden railing, which is used as a place of deposit for oil, and the more heavy and bulky articles used about the lighthouse.

At the height of 63 feet 9 inches, the stairway which has been described terminates in an apartment called the attendant's room, 12 feet in diameter, and 12½ in height, covered by an arch two feet thick in the crown. This chamber, lined with marble, is intended for the two persons who have charge of the light during the night. It is furnished with windows and the requisite conveniencies for containing a supply of lamps, funnels, wicks, oil, &c., &c., having a staircase of mahogany, with a balustrade, attached to the wall. The breadth of this stairway is 24 inches; the steps are a foot high and eight inches broad in the middle; it leads, through an opening left in the arch, to the platform, or upper part of the lower edifice.

Upon this platform is erected a second structure, consisting of a circular wall of hewn stone, 2½ feet thick, eight feet high, and 11 feet 7 inches in its interior diameter. The latter dimensions are determined by the base and diameter of the lantern, which, as has been before said, rests upon it. In this second part of the tower there is a door six feet high by 27 inches wide, to admit of egress to the platform, or corridor, above the cornice. In the floor of the apartment within the upper edifice, which is called the lantern room, and which is also lined with marble, there are two apertures; one in the centre, which is circular and 12 inches in diameter, into which is introduced the foot or support of the apparatus; the other is a foot and a half long by two inches wide, for the passage of the cord to which the moving weight is suspended. This weight is raised by means of a pulley placed in the arched ceiling of the attendants' room, and is enclosed in a case 13 inches square and 12 yards long, formed in the thickness of the wall of the lower part of the tower.

The total height of the tower is, therefore, 87 feet, which, added to the elevation of its base above the level of the sea, 65½ feet, and to the height of the light within the lantern, 5½ feet, will make the total elevation of the light, 158 feet; the horizontal tangent of which is 13½ marine miles. This exceeds, by 16 feet, the height desired in the report of the Marine department, and the light is consequently visible about a mile further than the distance required by them.

Description of the Apparatus for Lighting.—In order to give a clear and connected idea of this, we shall omit a detailed account of the numerous parts of which the various portions of this complicated machinery consist; and shall proceed to describe only such of them as will serve to make the mechanism understood, even by those who are not entirely familiar with the mechanical and optical principles upon which it is constructed.

The new apparatus for lighting consists of four distinct parts, as follow:—

1. The mechanical lamp.
2. The system of prismatic lenses and reflectors placed around the light.
3. The machine which gives a uniform rotary movement to the prismatic lenses.
4. The glass lantern which covers the whole, without obscuring the light.

The Mechanical Lamp.—This lamp, placed in the centre of the lenses and reflectors, is supported by a hollow pillar of bronze, seven feet two inches high, having, below, a receptacle for the oil, and a set of pumps for raising it. These pumps are worked by machinery similar to that of a clock, the moving weight being contained within the pillar, and are capable of raising four times the quantity of oil which the burners require; from which it follows not only that the flame is maintained with all possible brilliancy, but also that the superfluous oil which flows over the exterior surface of the tubes, and falls back into the cistern, cools the points of the tubes, which might otherwise be fused by the intensity of the heat. In order to increase the watchfulness of those who have the care of the light, it is furnished with alarm bells. The escapement of this machinery is connected with one end of a lever, and at the other, is suspended a vase with a small hole in the bottom. This vessel is so placed as to receive the superfluous oil from the burners, and while full, it sustains the counterpoise; but as soon as it begins to vary, on account of a deficiency of oil, the lever loosens the movement of the alarm apparatus, which gives notice of the irregularity. A first class light has three lamps, so that if one of them shall be out of order, there are still two fit for use in good condition, and the light is constantly maintained. The Havana light has four.

The Prismatic Lenses and Reflecting Mirrors.—The lenses and reflectors, the object of which is to concentrate the rays of light which proceed from the burners of the lamp, in order to give them a horizontal direction, are placed in a metallic frame conveniently arranged, and which, as well as the lamp, rests upon the capital of the bronze column. One part of this frame, which contains the reflectors, is stationary; while the other, containing the prismatic lenses, revolves around the lamp with a uniform motion. This revolution of the lenses causes eclipses of the light, according to the different positions which they successively occupy around the burner, producing a more intense and lively brilliancy in the direction towards which the focus of each lens happens to be directed, continuing thirty seconds before it is replaced by the next; though, on account of the stationary portion of the apparatus which contains the reflectors, there is always afforded, in all directions, a less brilliant light, but one which is still sufficient to enable the lighthouse to be kept in sight.

The Machinery which gives motion to the Prismatic Lenses.—The mechanism of this is like that of a clock, and is placed at the side of the bronze pillar which supports the lamp. A pinion wheel, gearing into another connected with the movable portion of the apparatus, puts it in motion by the action of a weight suspended to a cord passing through the floor of the room which contains the machinery, and descending below into a case made in the wall of the tower.

The Lantern.—The glass lantern, which encloses the light, rests upon the circular wall built above the cornice of the tower, and has the figure of a prism of sixteen sides. It is covered by a cupola of copper, with a chimney in its top to carry off the gases proceeding from the combustion; the whole being surmounted by a weathercock.

By the foregoing description, it will be perceived that this lighthouse, when illuminated, presents constantly a steady light, uniformly alternating, every six seconds, with brilliant flashes, by which it may be distinguished from any other light.

The intensity of the steady light is equal to that given by 550 burners like those of the ordinary Carcel lamp, which consume 3¼ ounces of oil per hour, and it may be easily seen at a distance of six or seven marine leagues. The brightness of the flashes is nearly four times as great as that of the steady light, and equal to that given by 2000 of the above-mentioned Carcel burners.

Data for determining the proper thickness for the Wall of the Tower.—The most interesting and nice question which first presents itself, in considering the construction of a very high tower, is to determine the thickness which its walls ought to have in order to insure the necessary stability, and to resist successfully the forces which have a tendency to destroy it. This is a general principle in all kinds of edifices; but in high towers, the base of which bears a small proportion to their height, it is necessary to consider another element of destruction, more powerful and active than the force of gravitation: namely, the violence of the wind in those great hurricanes which are so frequent on sea-coasts, and particularly among the Antilles.

In the calculation of this force, as in all physico-mathematical questions, the data are, for the most part, derived from experiments, of the accuracy of which we cannot be precisely certain; but which have been found sufficiently worthy of confidence when applied to similar structures which have, for many years, resisted every kind of force; and in this case there is nothing more logical, or natural, than to take the result of these calculations as established data of comparison with reference to our own case.

The data upon which we should reckon in calculations of this kind, founded upon numerous experiments, are as follow:—*First*, The pressure upon a superficial metre, when the wind has a velocity of 50 metres per second, which is that of the greatest hurricanes, is equal to the weight of 275 kilogrammes, or about 386 pounds to the square yard. *Second*, The action of the wind upon a vertical cylinder is reduced to two-thirds of the force which it exerts upon a central vertical section of the same cylinder.

To apply these rules to the stability of a tower composed of a single stone in the form of a right prism with a square base, we should multiply the superficial area of one of its sides by 386 pounds; and this product being multiplied by half the height of the prism, will give the momentum of the wind's force. In order to determine the momentum of resistance, the total weight of the tower should be multiplied by half the width of its base. Dividing this product by the first obtained momentum of the wind, we have the expression of the *absolute stability* of the edifice with regard to the action of hurricanes.

Towers are composed of numerous courses of cut stone, the adhesion of which affects the stability in proportion to the decrease in the size of the blocks of stone used. If we suppose this adhesion to be nothing in a wall composed of courses of stretchers and ties, the fracture caused by the force of the wind will not be horizontal; but (as in retaining walls) according to an oblique section, the inclination of which is determined by the maximum of relation between the force of the wind and the momentum of weight of the solid above the section. But it should be observed that in most high towers, the adhesion of the cement and the arrangement of the materials is such that the section of rupture is less inclined than in ordinary containing walls, and if, in addition to this, we also consider that the results which we seek are of comparison between our tower and those whose stability has been already tested by having for a long time resisted, without injury, every kind of force; the supposition that the section of fracture would be horizontal should have no sensible influence.

The determination of the section of most easy fracture offers a problem of minimums, the direct solution of which, in general, requires very tedious calculations; but fortunately the position of that section is apparent, in most cases, at the first glance of the eye, or may readily be determined by a few trials.

In case the tower should have the form of a truncated cone, like that of which we are treating, if it should ever yield to the force of the wind, it would be twisted off above the offset of its base, in the direction opposite to that from which it receives the force, and its being broken above the offset would be because the arm of the lever of resistance, instead of being equal to the radius of the section of rupture, is somewhat less.

These principles being established, it is known that, in order to give great stability to a circular wall in ordinary structures, it is sufficient to make the thickness a twelfth part of the height; consequently, having to raise our tower to a height of eighty feet, a thickness of seven feet was enough for the wall; but as the tower is not an insulated wall, but has within it, a circular stairway which binds and fastens together all its parts, and, moreover, as the consideration of a convenient situation for the illuminating apparatus required that the upper part of the tower should be only 20 feet in diameter, we were able to start with seven feet at the base, and to diminish gradually to four and a half at the top, with the advantage of an exterior slope of two and a half feet in the whole height, which also adds to its strength.

Having established these data, it now remains to examine whether, with these dimensions, the tower possesses as much, or greater, strength than others similar to it, which have been built many years, and have resisted, without the least damage, the force of the greatest storms, and I say it ought to be stronger: 1st, Because the terms of the comparison which we seek are derived from towers built in Europe, where hurricanes are neither so frequent nor of such long duration as in the Antilles; and, 2nd, Because the tower which we have constructed, from its peculiar situation, has to sustain not only the force of the wind but the shock of the waves, although this is somewhat diminished by the tower's being placed 22 yards above the level of the sea.

For comparison, we will take the signal tower erected in 1715, at the port of L'Orient, the form of which is similar, on the whole, to that constructed at the Moro, and which has withstood until the present time, without injury, all the force of the storms.

Stability of the Tower at L'Orient.—The result of a calculation with regard to this tower shows that the relation of the resistance to the pressure is 7·4; that is to say, the resistance is 7·4 times greater than the pressure. Let us now see what result will be obtained by an analogous calculation with regard to the tower at the Moro.

Calculation of the Stability of the Tower at the Moro.—The content of the truncated cone which constitutes the lower part, is 31,174 cubic feet. The interior cylinder, which contains the staircase, is 11 feet in diameter and 34½ in circumference; the area of its base, 95 square feet; and its content, 95 × 78 = 7410 cubic feet. Taking this from the total solid content, there remain 23,764 cubic feet for the solid content of the circular wall of the lower part of the tower. The cylindrical column in the centre of the circular stairway contains 450 cubic feet, and the stairway itself 306; so that the total solidity of the masonry in the lower body of the tower is 24,520 cubic feet, or 908 cubic yards. Adding to this three cubic yards for the projection of the cornice, and subtracting 36 yards for the apertures left for doors and windows, there remain 875 cubic yards of masonry. As the attendants' room, in the lower section of the tower, is a foot larger in diameter than the interior space occupied by the stairway, it follows that the amount of masonry, which on this account has been rather over-estimated, will be made up by the arched ceiling of this room, which has not been taken into the account.

The solid content of the circular wall which forms the upper section of the tower, upon which the lantern is placed, is 27 cubic yards, deducting the opening for the door; so that the whole amount of solid masonry is 902 cubic yards.

A cubic yard of the masonry used in this tower weighs 85 arrobas, (25 pounds each,) and the arm of the lever of resistance being four yards, (a little less than the radius of the base,) it follows that the power of the resistance will be 902 × 4 × 85 = 306,680.

A central perpendicular section of the lower portion of the tower contains 195 square yards; of the upper portion, 13; and of the lantern, 26; presenting a total sectional superficies of 234 square yards. The centre of gravity of these three superficies is found at 13 yards from the base of the tower; consequently, the momentum of pressure from the wind, is $\frac{2}{3}$ 386 × 234 × 13 = 31,504 arrobas, and the ratio of the resistance to the pressure $= \frac{306,680}{31,504} = 9{\cdot}7$.

By this result it will be seen that the tower at the Moro has a stability equal to nearly one and a half times that of the tower at L'Orient, which was taken for comparison, and consequently that its dimensions are sufficient, although indispensable for the reasons already mentioned, to warrant the undertaking of its construction with entire confidence.

Details of the Construction.—Foundation. As the tower is 25 feet in diameter at its base, a circle 28½ feet in diameter was traced around the centre of the area to be occupied by it; so that the excavation for the foundation being larger than the body of the tower, a berm, or offset, of 21 inches, would be left by the extension of the foundation wall beyond that of the tower itself. The excavation was carried through the surface soil down to the rock which underlies the glacis of the Morillo, which was reached and laid bare at an average depth of 15 feet.

The rock presented an irregular surface, in consequence of which, together with its extreme hardness, the operation of cutting it down to a level would have been very expensive. It was therefore deemed preferable to construct the foundation by steps, *(en escalones,)* using blocks of stone of the best kind, disposed in circular horizontal layers, *(formando anillos en capas horizontales,)* properly placed, and the joints filled with a mixture of lime and sand; taking care, as in all masonry of hewn stone, that the joints of each layer should be covered by the course immediately above it.

The foundation is 9½ yards in diameter by five in depth, and consequently contains 355 cubic yards of masonry. The cost of its excavation and refilling was 1554 dollars, being 4·375 dollars per cubic yard. In the calculation of the original estimate it was assumed that the foundation would be only three yards in depth; consequently containing 213 cubic yards, of which the cost, estimated at 7·50 dollars per yard for the masonry, including the excavation, amounted to 1597·50 dollars, being an excess of 43·50 dollars.

In calculating this estimate of 7·50 dollars per cubic yard of masonry, it was proposed to use all the materials of the old tower; but as this would not be sufficient it was supposed that the stone still to be provided would have to be purchased and transported from the opposite shore. The great reduction which was made in the cost per cubic yard of this work, from that originally estimated, was owing to the following causes: *First*, Instead of buying from individuals the stones which were required, those were procured which remained unused from the erection of the fortifications at that place, and which had been taken from quarries opened for that purpose; on which account they were obtained at a much lower price, while, at the same time, the expensive transportation in vessels was avoided. *Second,* Because it was not necessary to purchase sand for making the cement, having used that which was found in the fosses of the fortifications.

The digging of the foundation was commenced on the 17th of August, 1844, and by the 24th of September it was completed and leveled off to nine inches below the glacis of the castle; being then in order for receiving the first layer of stone for the tower. During the same time the old tower was completely taken down, its materials, as has been already said, being used for the new foundation.

The lower part of the Tower.—Upon the level top of the basement, or foundation, the first layer of stone forms a solid floor over the whole, 25 feet in diameter; its outer border being vertical and forming a projection or socle of nine inches around the tower, as well as a step of the same height, for entrance into it. The building is then continued to the requisite elevation by successive courses of 18 inches in height. In order to give an exterior slope to the wall, and consequently to diminish its thickness in due proportion, the width of the blocks in the interior courses was gradually contracted, while those on the exterior were continued of the same breadth, so that the vertical joints might recede gradually towards the interior, and the masonry be well united together; thus avoiding the defect which would result from an equal diminution in the breadth of the blocks used in both the inner and outer faces of the wall, in which case, the vertical joints of each course would continue to be one above another, thus forming two distinct walls, without further connexion than that of the extending ties.

The circular stairway is composed of entire blocks of stone, which are inserted six inches into the wall, each of them forming two steps, together with the corresponding part of the central column, or nave, of the staircase. It was carried up at the same time with the wall of the tower, in order to insure the proper connexion and binding together of the work, and also served for use during the construction of the building; the order of proceeding being first to set the block of stone which formed two steps, and then to lay the corresponding course on the wall, and so on, successively. The nave, or central part of the stairway, is cylindrical throughout its whole height, except at the top, where it increases in diameter, with a view of gaining a certain space on the floor of the attendants' room. In order to give this proper form to the central column, its diameter was gradually enlarged, beginning at the 17th step from the top, and so continuing to the last; so that the stairway is only 27 inches wide in the last six feet of its flight.

The upper part of the Tower.—This is a simple circular wall of cut stone, composed of blocks in alternate order, and presenting nothing worthy of special notice.

Arch of the Attendants' Room.—This arch is in the form of a simple dome, and presents nothing remarkable in its construction. The thickness of the wall which supports it is that which is strictly necessary for the equilibrium, since the excess in the weight of its masonry, from the spring of the arch to the key, and that of the upper part of the tower, which also contributes to its stability, are more than sufficient to compensate for the weight of the apparatus for illumination, which rests upon the summit of the arch. But notwithstanding this, as the three openings in it somewhat diminish its strength, the precaution was taken, in order to avoid the least displacement, to fasten all the arch stones of the second and third courses, together with those of the first,, with iron clamps, one and a half inches thick by three inches wide, let into the arch stones and fastened to each of them by a bolt, which passes through two-thirds of their thickness, well secured with lead.

Materials.—The stone used in the construction of the tower was taken from the quarries known here by the name of *playa de chivos,* immediately at the point where the tower stands, and preferable to the stone found at any other place in the vicinity, because, although not of the hardest quality, they are still sufficiently so, and of a more equal and homogeneous texture than the others. Great care was also taken to use blocks of the most durable kind in the exterior surface of the wall, and for the steps of the stairway.

The lime and sand employed were both of excellent quality; the former made of a very hard and clean stone, and the latter containing no saline matter. The mortar was made with great care, composed of two-fifths of lime and three-fifths of sand, mixed with fresh water and well stirred, so as perfectly to incorporate the ingredients.

The doors, windows, interior balustrades, and hand rails of the staircase are of mahogany.

After the completion of the edifice, in order to preserve it from the effects of moisture and of nitrous salts, inasmuch as the stone, as already stated, is not of the hardest kind, it was covered, both on the interior and exterior surface, with a very thin and well laid coat of painted stucco.

The cost of the whole structure, when completed, was very nearly that calculated in the original estimate.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

On Balances. *By* FRANKLIN PEALE, Chief Coiner of the Mint of the United States.

(With two Plates.)

In order to insure precision and regularity, to obtain facility and rapidity, and, above all, to avoid liability to error, it has been found necessary to combine, in the balances used in the mint, not only all the arrangements known to us that have heretofore been found important, but also such improvements as have been the growth of our own experience.

The result has been satisfactory, in a remarkable degree; so much so, as to be a subject of surprise to the most experienced of the corps of officers of this establishment.

In the present communication, no attempts will be made to establish claims of invention, either for ourselves or others. In fact, it would be impossible to do so with justice. Balances of every variety of structure have long been made, and may be readily met with; and all that we can now claim is, after much experience in their use, to have combined their best parts, and, in doing so, to have introduced such modifications and adaptations as have been found desirable.

In the balances, of which this notice treats, two considerations have claimed particular attention: the first is precision, the second construction.

Under the former head, a descriptive notice will embrace remarks on such provisions and operations as are deemed important; and under the latter, a description of construction, illustrated by engravings of the balance as erected, and of the separate parts in detail.

To obtain the greatest degree of uniform precision, it is requisite that the beam should be lifted, from a state of rest, in a perfectly level position, and that the stirrups should be lifted, simultaneously, with their loads, from their rests, or supports; also that the oscillations of the stirrups should be prevented or checked at the earliest moment; and, finally, that the whole system should be left at liberty with delicacy and exactitude, so as to remain in equilibrium, or vibrate, as the case may be.

To command the above conditions, the beam should be supported upon cones, at each extremity, adjusted level with each other, from which it is lifted, by a plane which rises under its centre knife-edge, and to which it is returned by its depression, the cones guiding the beam to the same position exactly from which it was elevated.

The stirrups, in like manner, should hang upon hollow cones or V's, so as to be taken up from, and returned, invariably, to the same position.

The support for the centre knife-edge, as well as the hangers which rest upon the knife-edges at the extremities of the beam, should be planes, and not portions of hollow cylinders, as is usual.

The beam should rest upon its cones, and the stirrups should be supported by their V's at such heights as to relieve entirely the knife-edges, with a sufficient space between them and their respective planes to permit inspection and wiping, when it may be needed. This construction admits of the placing of the weights, &c., and guards the knife-edges from the consequences of displacement during use.

The beam should be raised by the elevation of the centre plane, subsequently lifting with it the stirrups with their weights and load, and all oscillation checked by platforms placed in the table under the centre of the stirrups, which should be made to rise simultaneously, and should be counter-weighted to the requisite delicacy.

The descent of these platforms, effected by the pressure of a finger on a lever conveniently placed, will leave the stirrups, &c., at liberty to vibrate, or bring the beam to a horizontal position, at the will of the operator; being a convenient, certain, and rapid method of manipulating, not equalled by any other arrangement, and, in fact, essential to a well-constructed balance.

The knife-edges should be constructed of the best cast steel, hardened to the utmost ability of that metal, and the planes upon which they bear should be made as true and perfect as possible; those for the finer or more elaborately finished beams, should be of agate, or chalcedony.

Having thus concisely stated the essential qualities in balances for accurate and rapid weighing, it will be proper to explain the construction by which these qualities are acquired, being the second branch of this essay. In explanation of this, reference is now made to engravings which accompany this notice: one, exhibiting a front view of the whole; the other, the parts separate and in detail.

Description of the Plates, with Explanatory and General Remarks.

Plate I represents a front view of the balance drawn on a scale corresponding to a beam four feet in length, suited, in its proportions, to weigh one thousand dollars in silver. The weight to which it is limited should not exceed one thousand ounces troy.

A beam of three feet in length is suited to drafts of five thousand dollars in gold coin, and the maximum weight should not exceed, in any case, three hundred ounces troy.

The proportions exhibited in these plates may be maintained throughout for the above sizes, or any other, either greater or less, than those which are stated.

A table, marked A, is furnished with leveling screws upon the front and back edge, and at each end, marked *b*. In plate II, which exhibits different views of all the parts, the leveling screws are marked *b*, and their positions in the table (the view of the under side of which is given) are marked *c*.

The balance is intended to be placed upon a counter, or any other firm support, and the table leveled by means of the screws last described, its true position being indicated by a plumb-line and weight occupying the rear opening in the column; (plate I, fig. *c*;) the plumb-line and weight being marked *d*.

The column, marked C, in plates I and II, contains the lifting apparatus, and supports the cap-plate, marked D, plates I and II. The cap-plate guides the lifting apparatus, and supports the V's, or hollow cones, for the stirrups, and is strengthened and stayed by braces, marked E; the section of which braces is cruciform, with circular ends, for firm bearing upon the plate and base of the column, to which they are secured by screws.

Plate II exhibits upper and under views of the table, column, plate, &c., also upper and lower end views of the column, showing the means of its attachment to the table and cap-plate.

Balances intended for service alone may be made of cast iron, exclusive of the beam For small balances, or when higher finish and display is designed, bronze, or ordinary brass, may be used.

The lifting apparatus consists of a winch-handle, marked *f*, plate

II, fitting upon a round shaft, *g*, with a feather, so as to admit of its convenient removal; upon this shaft is fitted a cam, *h*, also secured by a feather; the cam is carefully constructed, so as to give equal elevation to equal parts of its revolution; and upon the cam rests a roller, *i*, which turns upon a pin in the frame, *j*, intended to reduce friction, and give facility in raising the beam with its load.

The lifting frame, *j*, is forked cross-wise, so as to straddle the shaft and accommodate the cam and roller, at the same time that it allows the necessary vertical motion, without the possibility of being displaced; all of which is exhibited in the two views of the lifting frame marked *j*, which is also accompanied by sections in proximity to the parts which they are intended to explain.

The handle is so placed as to be on the left when the beam is down and at rest, and to the right when the beam is raised, in the act of weighing, and makes, together with the cam, more than three-fourths of a revolution, the cam having a very slight depression upon its upper, or highest point, into which the roller falls, maintaining it in its position when the beam is raised. It is then extended beyond the centre of the roller, so as to be stopped at the limit of motion, as exhibited in fig. *h*, plate II.

The lifting frame is forked at the top for the accommodation of the beam. Upon it rests the plane, the top and side view of which are marked *k*, for the support of the centre knife-edge, secured to the frame by screws. In balances of ordinary construction, this plane may be made of hardened cast-steel; in finer instruments, of bronze, or brass, with an inserted block of polished agate, secured by fusible metal, or cement.

The position of the handle, lifting frame, &c., are exhibited with sufficient clearness in the front view, plate I.

The cap-plate, views of the upper and under sides of which are given in plate II, fig. D, is constructed with horizontal spaces at the centre and each end. In the middle it is secured to the column by four screws, and to the braces B in the same manner, the holes for which are marked in all the views.

The square opening in the middle serves as a guide and support to the lifting frame, which must be accurately fitted, so as to prevent any lateral play.

The horizontal spaces at the extremity of the cap-plate support short pillars terminated by cones, upon which the beam rests; these pillars are secured to the cap-plate by screws passing through it from the under side, the holes through which they pass being large enough to admit of the adjustment of the beam to its proper place, previous to their being permanently fastened down.

The details of these pillars are given in plate II, fig. *l*, the cones being constructed of cast steel, hardened and polished.

The same space also supports the V's, or guide supports of the hangers, different explanatory views of which are given in plate II, the V's being marked *m*, and the hangers *n*. All these parts have been devised with reference to the simplest and most economical construction consistent with the requisite accuracy, and for affording the greatest facility in the final adjustment of the balance.

The most important part of the balance is the beam, the form and material of which, both with reference to use and construction, have been carefully considered. Plate II, fig. *o*, exhibits side and top views. It will be observed that the beam is perfectly simple in its form, thickened at the centre and extremities, for the security of the knife-edges, the arms being diminished, in depth, regularly, from the middle to the extremities, a section in any part of which would represent a sharp wedge, with its extremities rounded, as shown by the dotted lines at *p*, the thicker being the upper edge of the beam. The projections marked *q*, are the supports of the beam when at rest; the conical cavities, indicated by dotted lines, being made to fit the cones marked *l*.

This form of beam affords facility in construction, being composed of straight surfaces, without ribs, or curves; is well adapted to maintain its form when loaded; affords the least surface for accumulation of dust, and is readily wiped when it may be necessary. The means of adjustment for the length of arm is exhibited in fig. *r*, plate II.

As a general rule, convenient and accessible means of adjustment are to be deprecated. Balances should be constructed with reference to the use to which they are destined, and the necessary accuracy and sensibility given in construction. It will be found, it is believed, more inconvenient than desirable, to attempt to change the sensibility of a beam devoted to different uses. Again, a person might have sufficient mechanical skill to use a balance and weigh accurately whilst it is in order, who would be much embarrassed by the consequences of a change in the centre of gravity, affecting the accuracy and sensibility respectively, without consciousness of the cause, or knowledge of the effects. A repetition of the remark, that prominent and accessible means of adjustment are to be deprecated, will be excused, as having a tendency to invite to attempts at adjustment by the incompetent and unskilful, or it may be to derangement, by the meddlesome.

The material best suited to the construction of beams will depend upon the purposes to which they are destined. For mint usage they should be of rolled brass, or a malleable alloy of copper and tin, well hardened by heavy hammering. The difficulty of procuring castings perfectly sound, and free from "blows" being a sufficient reason for the rejection of cast metal of any kind.

It will be seen, that the needle of the balance, which is the subject of description, is pointed downwards, and there are good reasons for this disposition. In the first place it is directly before the eye of the operator, and therefore more convenient in use, than it is, when elevated above; again it may be made longer than the arms of the beam, and will consequently describe a larger arc, and thus give more distinct indications, whilst the whole arrangement need occupy no more space than is requisite for the other parts; and finally, the needle is protected from external injury by the lifting-frame and column, in the centre of which it is placed.

The parts which remain to be described have been usually considered of minor importance, but experience has shown that this estimate is scarcely a just one, inasmuch as they afford facilities for accuracy and rapidity, that leave no doubt of their value, and place them in a most important position in practice. The parts now alluded to, constitute the system by which the operator is enabled to find the equilibrium of which he is in search. It consists of the pedestals, as they have been termed, marked *s*, plates I, and II, and the parts connected with them, marked *t*, *u*, *v*, and *w*, in plate II; a light shaft, made of tubular iron, *t*, supported by pivots *u*, which pivots are screwed through a piece cast on the under side of the table, marked V; upon the ends of this shaft there are levers, W, upon the ends of which levers, when in place, the pedestals rest.

The remaining part of this system is a double armed lever, placed in the middle of the shaft, *t*, (represented in the engraving detached,) and marked *x*; it is connected by a pin, with the trigger, *z*, represented in its place in plate I, with the same letter. Upon the other end of the lever, *x*, there is a weight, *y*, capable of adjustment by a screw upon which it traverses, so as to be approached to, or receded from the shaft, *t*.

The action of this system is easily understood, its whole object is to depress the platforms by sufficient force, applied by the finger, to the trigger, the counter weight returning them to their original position, after its removal.

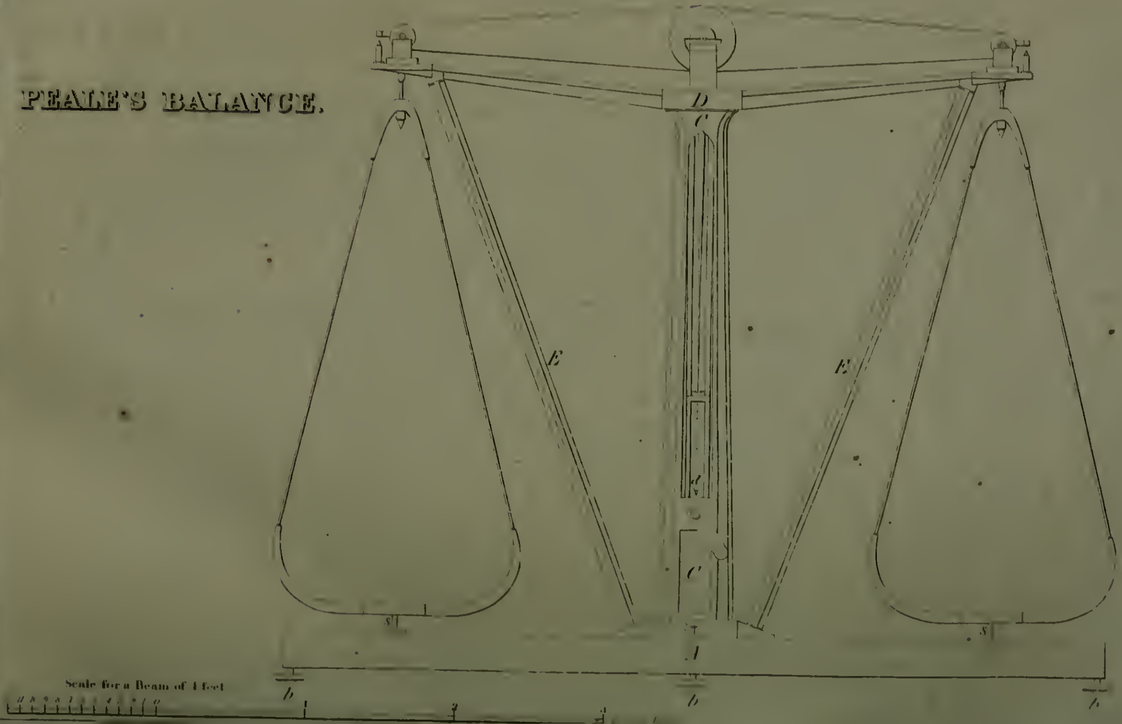
It will be seen, by reference to plate I, that the under sides of the stirrups have a space, represented by dotted lines, in which the platforms are placed, which allows the stirrups to oscillate within its limits, but beyond which they cannot move. This construction is intended to guard the hangers from displacement, and to prevent injury by too much movement of the stirrups, an accident very likely to occur, when the pans or weights are hastily removed, especially in the use of the larger balances with heavy weights or large masses.

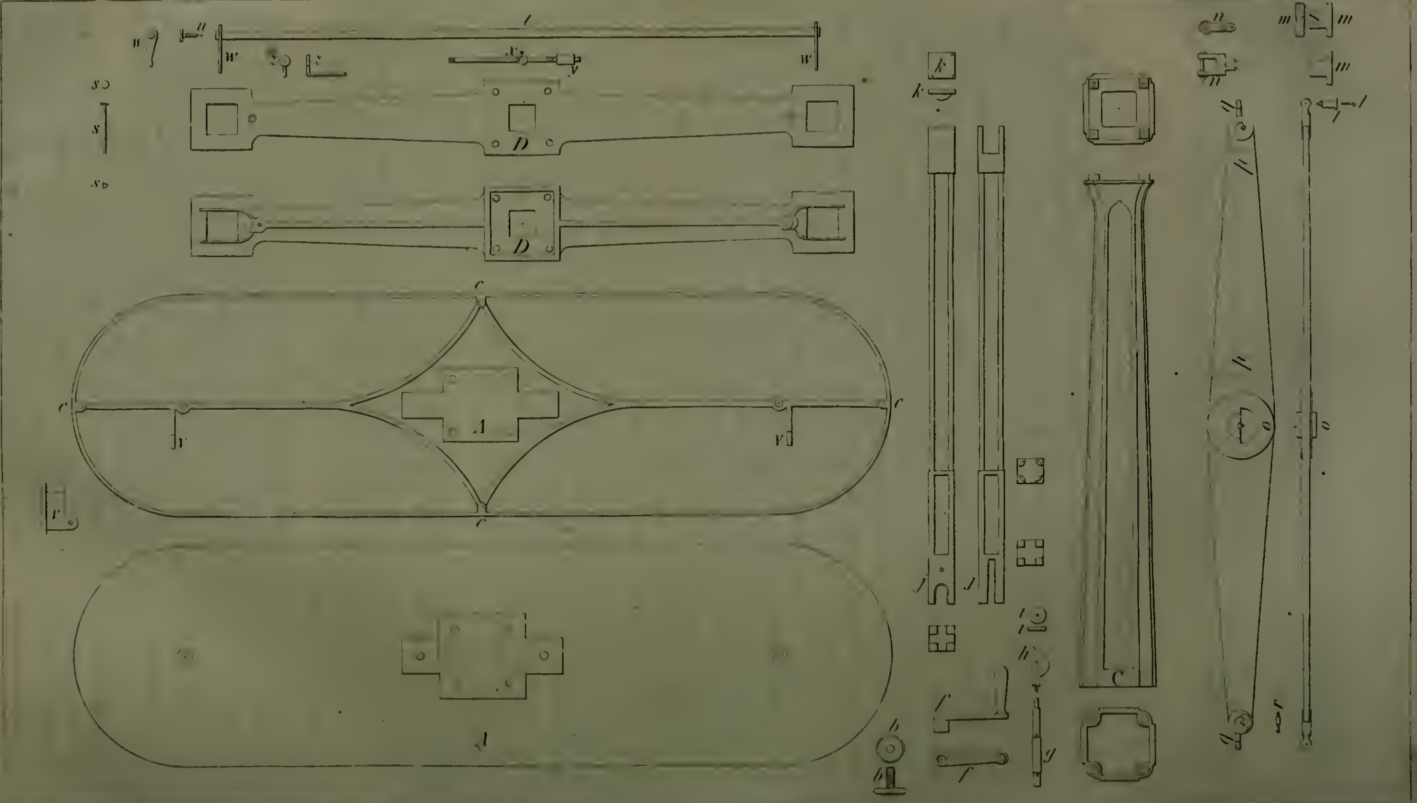
The cavity, whose object was described in the last paragraph, forming the under side of the base of the stirrups, is turned as truly as possible in the form of a portion of a sphere, whose radius is its distance from the bearing of the knife-edge. The platforms are adjusted by means of the counter weight, so as to press lightly up against the stirrups, and to follow them when raised.

It is found convenient in practice to turn the handle of the balance but a small portion of its movement, if the weights are not equal on opposite sides, a circumstance to be expected when searching for a weight. The heavy side will remain down, and the needle will indicate whether addition of weight, or its removal is requisite. These trials are continued until the platforms follow up the whole lift, the needle remaining opposite the middle line of its scale, until the handle is stopped by its limit of motion, where it remains. The finger, then, by pushing down the trigger, will depress the platforms, when smaller weights are employed until the needle indicates equilibrium.

In this balance there is little or no embarrassment from oscillation, because the stirrups immediately accommodate themselves to the position of the weights, the light pressure permitting them to take any

PEALE'S BALANCE.

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position required by the load; nevertheless, having sufficient power, from their pressure, to prevent any swinging. If from any cause the stirrups should be in motion, three consecutive depressions of the platforms, will bring them to a state of rest, with absolute certainty, and with a loss of time so short as to be entirely immaterial.

The stirrups are connected with the hangers, by a rod, which is double-jointed, as near to the hangers as possible, so as to allow perfect freedom of motion; at the same time, so well fitted as to allow no change of position in the parts. On the lower ends of these rods, there are screws and nuts, to regulate the height of the stirrups, together with a jam nut, to prevent any change after the adjustment has been satisfactorily made.

The bases of the stirrups are designedly made small, requiring the use of a dish on the one side, and a platform for weights on the other. This dish and platform being made of equal weight, renders the use of a counter weight unnecessary, and as the balance cannot be used without both, the liability to mistakes from this cause is entirely avoided.

For the adjustment of weights, or any other use of balances requiring the greatest degree of delicacy and care, it is necessary to protect the instrument and the operation, by a case, with doors sliding vertically, and glazed, so as to permit inspection, undisturbed by currents of air. This arrangement, entirely essential for such uses, is inadmissible for ordinary weighing, involving too much delay in the necessity for opening and shutting the doors.

In the balance for weighing gold coins, which was placed in the exhibition of the Franklin Institute, in 1846, and which is now in use in the weighing and counting room of the chief coiner's department in the mint of the United States, all the parts, with the exception of the stirrups, are covered by plate glass, inserted into the framing, so as to protect the balance as much as possible from currents of air, dust, and external influences of all kinds. This balance has been made with the utmost care in all respects, upon the principles detailed in the foregoing notice, and the result has been satisfactory in the highest degree. In illustration of which, it may be stated, that with its maximum load of six hundred ounces, three hundred on each side, it is sensible to the ten-thousandth of an ounce. This fact is not mentioned as very remarkable, because it is comparatively easy to give great sensibility to balances: but it is worthy of note, that it is invariable in showing this minute fraction of its load. As regularity is of the greatest value in operations with balances, we may be excused for drawing attention to a quality of so much importance.

Descriptive Memoir of a New Process for Manufacturing White Lead, or Carbonate of Lead, invented by M. Gannal.

TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

The difficulties which are known to exist in the manufacture of white lead by the processes now in use, and the dangers to which the workmen employed in it are exposed, determined me to undertake a series of experiments, in order to discover a process more simple and without danger to the workmen.

I feel truly happy in being able to announce to the Academy that I have succeeded in my attempts. *By a process extremely simple, in a very short time, without any danger*, I manufacture any quantity of white lead that commerce may require, and my product will bear comparison with the most perfect that is made.

Among the chemical and mechanical processes thus far known, for the manufacture of white lead, not one appeared to me to combine the conditions necessary to obtain this product with economy and without great danger to the workmen.

A patent, taken out in 1834 by Mr. Walker Wood, points out a method, some parts of which, indeed, seem to be new; but the descriptions of this patent are so obscure, and at the same time so erroneous, that I have not thought it worth while to dwell on it.

The following is the description of the manner of proceeding, by which I arrived at a good result:

A hexagonal or octagonal leaden cylinder is to be prepared, two metres in length, with a diameter of from thirty to forty centimetres. The lead should be from five to eight millimetres in thickness. This cylinder is to be enclosed in a frame made of rod-iron; to one end of which a crank is to be attached. It is to be placed on a stand, so as to receive with ease a rotary movement.

At the centre of the cylinder there is to be an opening or bung-hole through which the materials are to be introduced. At the end opposite the crank and in the axis of the cylinder, another opening is to be made, of from three to four centimetres in diameter, through which is to pass, without closing or stopping it up, an elastic tube fitted to a bellows. This tube must reach the bottom of the cylinder.

100 kilogrammes of granulated lead and thirty litres of water are to be introduced into the cylinder; the bung-hole is to be closed, and the apparatus is ready to operate. In this state, if the lateral opening is closed and the apparatus turned round at the rate of forty-five or fifty turns per minute, and if this motion is continued for five hours, about two thirds of the lead will be found reduced to an impalpable powder and still retaining its metallic color.

If the lateral opening remains open, then the lead so divided becomes oxidated, and the product taken out is a protoxide, or massicot, hydrated in part.

Lastly, if an elastic tube reaching to the bottom of the cylinder is fitted to the apparatus, the other end of which is attached to a bellows receiving air from a close chamber or enclosure in which there is burning charcoal; the finely divided lead coming in contact with the air and the carbonic acid blown into the apparatus by means of the bellows, is converted into oxide, and finally into carbonate of lead or white-lead.

Acting on this principle, we manufactured a considerable quantity of a product, which was judged to be equal in quality to the best of that met with in commerce.

When the cylinder has been turned for a sufficient length of time, the bung is to be opened, and the liquid contained suffered to run out; a quantity of water equal to that first introduced, is put in, the cylinder is to be turned for five minutes, this second portion of liquid is to be run off, then the apparatus may be immediately re-charged for a second operation, introducing, however, only seventy-five kil. of lead, inasmuch as there remain twenty-five to thirty kil. not finely divided.

In order to facilitate, and hasten the operation, we have made use of two different processes. The first consists in pouring into the water, at the moment of charging the apparatus, five hundred grammes of nitric acid. The second in substituting for the acid one kil. of nitrate of lead.

It is, however, to be remarked, that during the operation a little nitrous acid is disengaged, and that when the operation is completed, scarcely any is to be found in the mixture that remains. I have observed that the acid or the salt of lead is decomposed. A sub-hyponitrite is doubtless formed, which is afterwards decomposed by the carbonic acid.

The liquid product, withdrawn from the cylinder, is poured into a vessel containing eight or ten times the proportion of water made use of in the operation. This mixture, violently agitated, becomes considerably whiter, in proportion to the blue tint of the product taken out of the cylinder, which is occasioned by a quantity of lead, finely divided, but not yet oxidated, or yellowish, if formed of oxide not carbonated.

It is to be observed, that after two days washing, the whole of the product is of the most dazzling whiteness. However, I would here observe, that having dried immediately some white-lead which still contained about one-eighth of its weight of divided and non-oxidated lead, at the end of two months the entire mass had a homogeneous tint.

As in this operation some portions of granulated, and others of imperfectly divided lead, escape from the apparatus, it is necessary to let them deposit in vessels having openings at different heights. In the first place the clear water which floats above the deposit is drawn off, then by an opening somewhat lower down, the pasty deposit, which rests on the imperfectly divided particles of lead.

The pasty mass is thrown on filters of closely woven cloth, which have been previously fixed on frames. Here a large quantity of water drains off and leaves a plastic residuum. In this state, the filters are taken down, the ends of the cloth are folded over, and the whole is subjected to a violent pressure.

When this pressure has removed the greatest quantity of water possible, the packets are taken out, the cloths are taken off, the mass is divided into pieces of the desired form, and they are then placed in a hot air stove.

As may be seen, the theory of this operation is as simple as its manipulation. In adopting this system of manufacture, we have *simplification of labor, a larger product, saving of manual labor, and less chance of loss.*

Until the present period, our manufacturers, followers of blind routine, imitated the form which the Hollanders formerly gave to this article; but now, our workmen, our foremen are too well informed to pay any attention to the particular form or shape that may be given to a product. And when they learn that the adoption of this new form or shape has for its principal object the preservation of the health and life of many thousands of fathers of families, who annually perish in consequence of the fatal results of the present mode of manufacture, they will doubtless applaud the intention of my publication, and will hasten to call for white lead in a new form.

To sum up the whole, my process of manufacture consists:—

1st. In granulating the lead.

2d. In reducing it into indefinitely fine particles by friction on itself in a leaden cylinder.

3d. In facilitating the oxidation of the lead so divided by the introduction of atmospheric air into the apparatus.

4th. In *carbonating* immediately this oxide of lead by making use of air more charged with carbonic acid.

5th. In hastening the oxidation of the lead, by introducing into the apparatus nitric acid or the nitrate of lead.

6th. In washing the product obtained by this process.

7th. In hastening its desiccation, by subjecting the result to the greatest possible pressure.

8th. In dividing by square points the pressed mass.

9th. In drying in a hot-air stove the divided product.

On the 24th of December, 1839, a room and the closet of an apartment still occupied by M. Mequignon, Jr., rue des Grands Augustins, No. 9, were painted by Mr. Coulon with white lead manufactured by me by this process; this paint, after four years, is as beautiful as when it was first applied.

The publication now made is entirely for the benefit of the workmen. The manufacturers will hasten to adopt it; but I think, moreover, that taking into view public health, the government ought immediately to interdict the method of making it by putting the lead into pots, which is the principal source of the painters', or lead cholic.

Note—1 metre = 39·37 inches; 1 centimetre = ·3937 do.; 1 millimetre = ·0397; 1 kilogramme = 15434 grains; 1 litre = about 1 quart.

We take pleasure in inserting in the Journal the following interesting letter from Edward Miller, Esq., one of the engineers of the Pennsylvania Railroad Company, giving an account of a recent explosion of a locomotive engine upon the Allegheny Portage Railroad; and we hope that when others may have opportunities of ascertaining the circumstances attending the explosion of steam boilers, they will forward an account of the facts to the Franklin Institute.

Com. Pub.

Explosion of the Locomotive Engine "Bush Hill," on the Portage Railroad.

John C. Cresson, Esq.,
Chairman of Committee on Science and the Arts, Franklin Institute.

Dear Sir,—Upon the day I passed over the Allegheny Portage Railroad, April 23rd, 1847, one of the locomotive engines attached to a freight train exploded, killing the engine driver and injuring severely two other persons. I could not, at the time, obtain a correct statement of the facts, as business required me to proceed the same night to Pittsburg. Being at Johnstown on the 4th inst., I had an opportunity of examining the wreck and inquiring into the facts connected with the explosion, which I now send you, to be laid before your committee, if you consider them of sufficient importance.

The locomotive "Bush Hill" was built by Messrs. Norris, and put on the Columbia Railroad, April 17th, 1837. In the fall of the same year it was transferred to the Portage, where it has since been in constant use. It was a six-wheeled engine, weighing 12 tons, being one of the heaviest on the road, used the adhesion of two wheels, and was considered one of the best machines on the Portage. It was generally used as a freight engine, but had been running on the 13 mile level for some some days prior to the morning of the accident, with the passenger train.

On that day, the steam was raised by the fireman before breakfast, with the expectation that the Bush Hill would have to take the passenger train; but the regular passenger engine, which had been undergoing repairs in the Johnstown shops, arrived, and took its place. But for this change, the loss of life might have been much greater.

The fireman, John B. Davis, states that he tried the gauge-cocks before going to his breakfast, and found the water above the upper cock. He also tried them after breakfast, before the engine started, and found a full head of water.

The engineer of the Bush Hill, James Patterson, had gone down to Johnstown the night before, to ask that another person might be sent to run his engine, as he wished to attend a funeral. James Barron was accordingly sent up with him by the passenger line in the morning to incline Plane No. 1; but, as the funeral was to take place at the half way house, it was concluded that Patterson should run the engine that far, Barron accompanying him. The Bush Hill was attached to a freight train, and after proceeding about one quarter of a mile exploded, killing Patterson, and wounding Barron and Davis badly.

The only part of the boiler which gave way was the forward flue-sheet, the upper part of which was torn from the flanch by which it was riveted to the boiler, as far down as the upper row of copper flues, which were also torn loose. The remaining flues, and the whole cylindrical part of the boiler, together with the dome and fire-box, sustained no injury from the explosion. The rent followed strictly the angle of the flanch, without starting a rivet. The rush of steam forward threw the engine entirely over, and it fell backwards, bending the platform against the dome, and crushing the tender and one of the cars. The working gear was much bent and broken.

The flue-sheet was made of two plates, riveted together; the lower one, through which the flues passed, being of three eighths of an inch iron, and the upper, one-quarter inch. The upper plate was strengthened originally by two stay-bars, both of which were broken off, their fractures shewing that they had given way long before. No signs of want of water, nor of overheating, appeared in the flues, fire-box, or any part of the boiler.

The angle at the flanch of the flue-sheet where the rent occurred, was probably injured originally in the bending, as a very bad flaw extends not only around the fractured part, but also around the portion below the flues, which was not injured by the explosion. I have sent two portions of the flanch, by Mr. Power, to the Institute, from which this will be apparent.

Mr. James Bowstad, the foreman of the Johnstown shops, says, *he noticed last winter that the flue-sheets of several of the locomotives, including the Bush Hill, were sprung*, and he believes that in all these cases, the stay-bars are broken. The other engines which are in this condition are in daily use on the road, and they are unable to repair them, because there are no spare engines to supply their place. He considered the Bush Hill in good order in all other respects. He says that he examined it the day before the accident, in order to ascertain whether a new patch which had been put on the dome leaked. The steam was then high, but it did not leak of any consequence. James Barron states that, when he and Patterson got on the engine, the steam was escaping rapidly from this patch, and he thought it too high, for *it was very blue*. He did not, however, at the time, consider it dangerous. Neither Barron nor Davis knew anything about the condition of the safety-valve, and they have no recollection of hearing the steam blowing off at the valve.

Mr. Power, the Superintendent of the road, believes that the valve was screwed down by somebody while the fireman was at breakfast, during which time, the engine stood on the track, fired up, and waiting for the train, with nobody to look after it. This is, however, mere surmise; the injury to the valve preventing any conclusions as to its condition. The safety-valve was two inches in diameter, and the scale of the spring-balance would not indicate a greater pressure than 130 pounds to the square inch if screwed down as far as it would go.

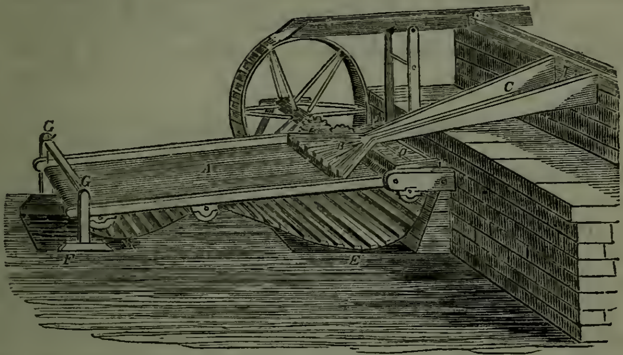
In conclusion, I will remark that the cause of this accident is more manifest than in any explosion I have had occasion to investigate. The evident flaw at the flanch of the flue-sheet, and the fracture of the stay-bars rendering an explosion almost inevitable, if any accident or carelessness should produce an unusual head of steam.

What can be said of the policy which compels the use of locomotives in such a condition as this? for there is good reason to believe that several others are in the same dangerous state. The number of these machines on the Portage is entirely insufficient to convey the traffic upon it with economy and safety; all of them have been many years in use, and many of them are engines which had been used on the Columbia road until antiquated, before being transferred to the Portage.

Very respectfully, Edward Miller, C. E.
Pittsburg, Pa., June 10th, 1847.

Brunton's Ore-dressing Frame.

As much attention is now being paid to the operations of this machine, by which a great saving is effected in the cost of dressing ores, we take this opportunity of giving a description of the process, illustrated by a diagram.



A is a piece of prepared canvas, 30 feet long, joined at the ends—thus forming an endless band, with slips of wood fastened transversely on the inside, and making, when stretched on frame and rollers, a surface of 12 feet long and four feet wide, the inclination of which is altered to suit the material to be operated on by the screws G G. B is an inclined plane, divided into several channels, in connexion with the trough C, into which is placed the ore to be dressed, from which it is washed and distributed over the channel B. D is a shoot, over which clear water runs. E is a cistern, or receptacle, where the cleaned, or dressed, ore is deposited; and F, another, into which the dirt and waste falls. By the action of the water-wheel, the endless belt is made to move continuously upwards against the stream; and as the work is washed on the table overhead B, where the stream is increased by the clean water, which two streams combined are sufficient to wash the waste over the end of the frame into cistern F; while the ore, by its superior gravity, resists the force of the stream, and is carried upward, being (while passing between the heads B and D) subject to the action of the stream of clean water. When the ore, thus separated from the waste, is carried up past the head D, it is free from all action of water, and adheres to the canvas until it touches the water in cistern E, when it directly falls off, and is deposited in the bottom of cistern E. Thus there is a continuous stream of material to be dressed passing over the inclined plane B—a continuous stream of waste going over the end of frame into cistern F—and a continuous stream of clean, or dressed, ore being deposited in cover E; and it is found that no other method yet adopted can either produce the same effect, both as regards the high produce of the cleaned ore, or the impoverished state of the waste, in which particular point the great saving is—as, let the person attending it be ever so negligent, no ore is being wasted so long as the water wheel is at work; while, in the old method, there is a great quantity of ore which finds its way to the tail of the frame, through the negligence of the party using it. On reference to our preceding column, sufficient testimonials will be found to satisfy the most prejudiced against innovation on the good old plans, that these frames effect a saving in labor, in dressing ores, of from 10 to 20 per cent.; while it is generally considered, by agents and dressers, who have had them in use for months, that the saving in ore is of considerably greater importance than that saving in labor.

Lond. Min. Jour.

Hot and Cold Blast Iron.

Mr. R. Stephenson, the engineer, has been making a series of experiments upon the relative strengths of hot and cold blast iron, the result of which will be a complete revolution in the iron trade. Hitherto, cold blast iron has brought a higher price, and has been considered in every respect superior to hot blast. Previous, however, to the construction of the high level bridge at Newcastle-upon-Tyne, intended to connect the York and Newcastle with the Newcastle and Berwick Railway, Mr. Stephenson caused more than one hundred experiments to be made with the various sorts of pig iron:—the result of which has been to prove that hot blast is superior to cold, in the proportion of 9 to 7; and, moreover, that pig iron No. 3 is better iron than No. 1, which, up to this time, has sold much higher in the market.

Athenæum.

Incrustation of Boilers.

Mr. Lamb, superintendent of the Peninsular Steam Navigation Company's steamers at Southampton, at the late meeting of the British Association, gave an account of a mechanical apparatus he has employed for the purpose of preventing incrustation of steam-boilers. It may be defined as a self-acting blow-off apparatus. He has a theory that "blowing off" should take place near the top of a boiler rather than from the bottom. He conceives that the carbonate of lime floats by means of small bubbles of steam adhering to each particle of lime. His contrivance consists of a large copper float closing the orifice of a blow-off pipe in the boiler. When the water has risen above a certain height, the blow-off valve is opened by the float, and so delivers the boiler of its excess of water. This hot water passes through a cylindrical chamber round the feed-water, so as to heat it on entering. The apparatus is simple, and is stated to have worked perfectly well.

Lond. Min. Jour.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA,

FOR THE

PROMOTION OF THE MECHANIC ARTS.

AUGUST, 1847.

CIVIL ENGINEERING.

Fourneyron's Turbine at St. Blasien.

The following is a plan of a quadrant of a horizontal wheel erected on Fourneyron's principle, in a cotton factory, at St. Blasien. The plan is drawn to a quarter the actual size.

In order to understand the action of the wheel, the reader must imagine the circles, of which the quarter only is drawn, completed. The machine will then be seen to consist of two parts—an inner wheel *fixed*, and an outer, or larger wheel, *revolving*. The water comes from the centre, proceeds along the guide curves F, F, which cause it to impinge directly upon the curved paddles D, D, attached to the outer wheel, which consequently revolves in the opposite direction to the impulse of the water. The shaded parts x, x, are stops attached to a drum J, J : the object of these stops is to shut off, when requisite, the communication between the inner fixed wheel and the revolving one. J, J, is capable of being raised or lowered by external machinery, and consequently x, x, descending between the guide curves, regulate the supply of water, or shut it off altogether.

Fig. 2 is a vertical section of the whole turbine, and shows the method in which the water is supplied to the revolving wheel.

The water comes first from the supply-pipe H, into the cylinder G, G, descends E, E, and falls on the fixed guide-curves F, F; from these it rushes in horizontal streams against the paddles in the revolving wheel D, D, and finally escapes at the circumference D, D.

Fig. 2.

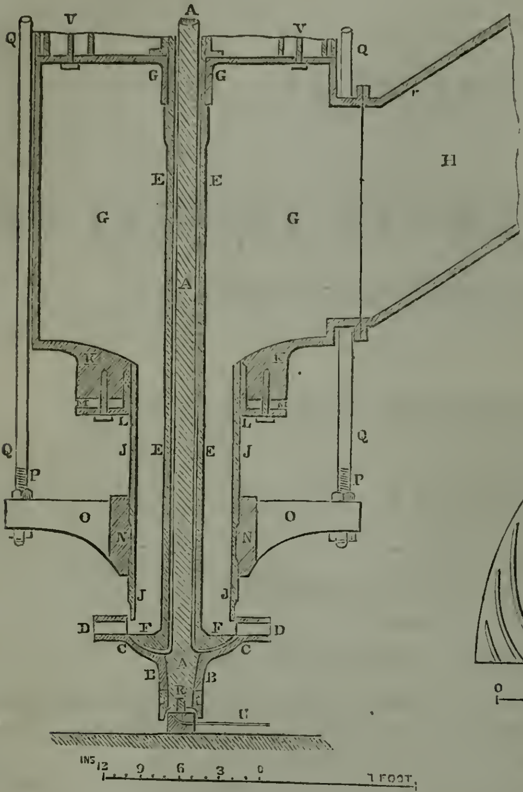
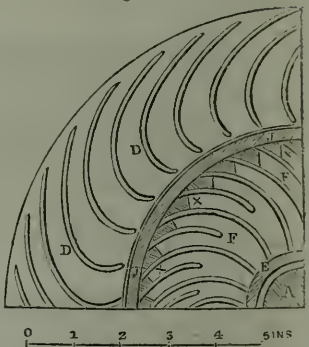


Fig. 1.



The revolving wheel is connected by C, C, with a shaft B, B, which turns on a pivot at its lower extremity. B, B, carries a main axle, A, A, which goes up through the water cylinder, and is applied to turn the machinery of the cotton factory.

J, J, as has been explained, is the sluice which regulates the supply of water. The manner in which J, J, may be raised or lowered is easily seen from the diagram. The arms O, O, contain matrices, in which the screws P, P, work: these screws are at the ends of long rods Q, Q, turned by winches not shown in the diagram. It is clear that, by turning Q, Q, one way or the other, the sluice will be either raised or lowered.

L, K, M, show the means of packing J, J, to keep it water-tight.

U is a little conduit by which oil is conducted from a small reservoir to keep the pivot R constantly lubricated.

The main shaft and pivot are of steel, the wheel of wrought iron, and all the other parts of cast iron. Though the wheel is only 12·50 inches in diameter, it drives 8000 water spindles, the roving frames, carding engines, and all the accessory machinery. The number of revolutions, with one-third of an inch sluice-opening, are 2200 per minute. The available fall of water is 350 feet.

The following is Rühlman's account of his first impressions on examining this machine :—

The second turbine erected by the inventor at St. Blasien, with a fall of 117 yards, has become more important than any other. I can best describe this turbine by detailing what I myself saw and learned upon the spot during the journey already referred to. Already, half an hour before arriving at the remarkable locality of St. Blasien, situated in one of the most beautiful, but also of the wildest and loneliest parts of the Schwartzwald of Baden, a curious noise announces the uncommon spectacle, which becomes more extraordinary as you approach.

On entering into the wheel-room, one learns there that what had been heard at a distance about this place was not merely mystification, but reality.

One then feels seized with astonishment, and wonders, more than in any other place, at the greatness of human ingenuity, which knows how to render subject to it the most fearful powers of nature.

At every moment the powerful pressure appears likely to burst in pieces the little wheel, and the spiral masses of water issuing from it threaten to destroy the surrounding walls and buildings. Often when I went out of the wheel-room, and looked at the enormous height from which the conducting tubes brought down the water to the wheel, the idea forced itself upon me, "that it was impossible," but that idea passed away when I went back into the little room.

Fourneyron has here, for the first time, solved a problem, which will forever render his name historical in the technical and scientific world ; a problem in which he had to overcome not only the greatest obstacles of Nature, but also disfavor and prejudices in a thousand forms. Who could find any other means of utilizing this existing water power? Perhaps a water-pressure engine might be applied? Certainly not; since even without proving, by calculation, how little that kind of machine is suited for rotary motion, it is only necessary to consider the very difficult and very power-destroying conversion of a vertical reciprocating motion into a uniform rotary motion, in order to sufficiently appreciate the difficulties.

The conclusions arrived at respecting the general merits of the invention seem well worthy of attention, for they are expressed by an impartial witness, who has taken great pains to get at the truth.

It is certainly not true that turbines are capable of totally displacing vertical water-wheels as was at first asserted. The greatest obstacles to the erection, construction, and working of turbines, at least in Germany, arise from the fact that many years must elapse before our millwrights will have acquired the necessary theoretical knowledge and practical experience. With these machines everything must be really calculated. It will not do to construct one wheel after the pattern of another, or to trust to what is called the practical shape. But also the construction of these wheels, in the workshop of the machine-maker, requires the greatest care, observation, and prudence, otherwise, no matter how it may be calculated, a good wheel cannot be produced.

It is now also fully admitted that Fourneyron deceived himself in supposing that these wheels economized 80 per cent. and more of the total available force. But the latest and fullest experience has shown that they economize certainly from 60 to 70 per cent., when those precautions are taken which should be attended to in their formation.

Civ. Eng. & Arch. Jour.

Railway Statistics.

The annual return of the Board of Trade recently published, contains some very valuable information on the subject of railway statistics. The following information is taken in a condensed form from that return:—

The total number of passengers, as given in the returns for the year ending 30th June, 1844, and for the year ending 30th June, 1845—

	1844.	1845.
1st class, . . .	4,875,332½	5,474,163
2nd class, . .	12,235,686	14,325,825
3rd class, . . .	8,583,085½	13,135,820
Mixed, . .	2,069,498½	855,445½
	27,763,602½	33,791,253½

The rate of increase of traveling in each class is—

1st class, . . .	12 per cent.
2nd class, . .	17 per cent.
3rd class, is upwards of . .	50 per cent.

The amount received for each class is as follows:—

	1843–4.	1844–5.
1st class, . .	£1,432,688	£1,516,805
2nd class, . .	1,375,679	1,598,115
3rd class, . .	483,069	651,903
Mixed, . .	147,858	209,518
Total,	£3,439,294	£3,976,341

The increase of returns on the year 1844–5 was, therefore, upwards of half a million on passenger traffic alone. On gross receipts from all sources it stood thus:—

1843–4, . . .	£5,074,674
1844–5, . .	6,209,714
Increase,	£1,135,040

The rate of fares on the lines included in the above returns, and the reductions in the two years, stand thus at the end of the year 1845:

	1845.				Reduction.		
	Ex-press.	1st Class	2nd Class.	3rd Class.	1st Class.	2nd Class.	3rd Class.
	d.	d.	d.	d.	d.	d.	d.
Great Western,	3·00	2·74	1·60	1·			
London and Birmingham,	2·88	2·45	1·81	1·	·74	·32	·48
Grand Junction,	2·44	2·08	1·71	1·	·92	·41	·59
Midland,		3·21	2·19	1·			·41
Birmingham and Gloucester,		3·16	2·37	1·			
Chester and Birkenhead,		2·00	1·60	1·			
Great North of England,	3·46	2·93	2·13	1·	·53	·26	·69
Hull and Selby,		1·93	1·54	·967			
Lancaster and Preston,		3·30	2·10	1·			
Leeds and Selby,		2·66	2·00	1·			
Brighton,	2·97	2·37	1·78	1·18	·47	·11	
Croydon,		1·42	1·14	·85			
South Western,	2·87	2·48	1·91		·70	·42	·26
Manchester and Birmingham,	2·47	2·11	1·62	1·	1·12	·77	
Manchester and Leeds,		2·28	2·00	1·	·94	·23	·41
Newcastle and Darlington,	3·23	3·07	2·15	1·	·15	·30	·36
Newcastle and Carlisle,		2·40	1·80	1·			
North Union,		2·45	1·63	1·	·54	·51	·36
Preston & Wyre,		2·52	1·89	1·			
South Eastern,	2·45	2·04	1·36	·82	·48	·28	·10
York and North Midland,		3·00	2·25	1·	·50	·25	1·00

Cattle, Sheep, &c.—The total number of cattle conveyed in the year 1844–5 is nearly two millions. The gross amounts received range as follows:—

London and Birmingham,	£50,000
Great Western,	17,000
Midland, and Bristol and Birmingham,	9,000
Eastern Counties,	5,300
South Western,	4,000
Manchester and Leeds,	4,000
York and North Midland,	3,200
Great North of England,	3,200

Horses.—The number conveyed is as follows:—

Bristol and Birmingham,	2,879
Chester and Birkenhead,	664
Eastern Counties,	2,160
Northern and Eastern,	2,796
Grand Junction,	4,267
Manchester and Birmingham,	785
Great North of England,	2,709
Great Western,	10,504
London and Birmingham,	10,749
London and South Western,	5,570
London and South Eastern,	2,714
London and Brighton,	4,303

Manchester and Leeds,	1,409
Midlands,	9,595
North Union,	989
York and North Midland,	4,197

Coal Traffic.—The following shows the gross tonnage and amounts received on the undermentioned lines in the year beginning 1st July, 1844, and ending 30th June, 1845:—

	Tons.	£
Arbroath and Forfar,	12,000	1,700
Ardrossan,	42,144	2,106
Ballochney,	282,622	3,206
Bristol and Birmingham,	70,000	3,708
Canterbury and Whitstable,	13,000	1,188
Clarence,	300,000	20,000
Dunfermline,	28,477	3,142
Durham and Sunderland,	372,714	22,712
Edinburgh and Dalkeith,	118,340	4,800
Glasgow and Ayr,	120,000	8,000
Glasgow and Garnkirk,	1,761,000	7,600
Great North of England,	181,012	13,079
Hartlepool,	796,486	32,627
Hayle,	20,000	2,400
Leicester and Swannington,	178,566	15,827
Liverpool and Manchester,	133,396	9,414
Llanelly and Llandilo,	92,381	6,067
London and Croydon,	6,000	500
London and South Eastern,	22,519	
London and Brighton,	30,000	2,400
London and South Western,	4,000	
Manchester and Bury,	49,826	3,332
Maryport and Carlisle,	119,375	7,244
Midland,	313,854	42,000
Newcastle and Carlisle,	205,500	19,476
Newcastle and Darlington,	400,000	
Newcastle and North Shields,	26,936	1,198
North Union,	321,923	
Pontop and South Shields,	662,829	49,591
Preston and Wyre,	21,538	4,289
St. Helens and Runcorn Gap,	229,775	9,762
Sheffield and Manchester,	58,668	2,447
Sheffield and Rotherham,	16,000	977
Stockton and Darlington,	900,000	80,000
Taff Vale,	125,986	19,939
Ulster,	807	130
Whitby and Pickering,	1,708	241
Wishaw and Coltness,	390,240	9,969
York and North Midland,	47,529	2,419

Rate per mile for toll only, and for total charges:—

	Toll. d.	Total Charges. d.
Canterbury and Whitstable,		6·00
Dunfermline and Charlestown,		4·29
Bodmin and Wadebridge,		4·25
Hayle,		4·20
Dundee and Newtyle,		3·37
Maryport and Carlisle,	1·16	3·33
Arbroath and Forfar,		3·30
Monkland and Kirkintilloch,		3·00
South Western,		3·00
Wishaw and Coltness,	2·27	2·90
Manchester and Bury,		2·30
London and Croydon,	2·00	2·25
South Eastern,		2·12
Brighton,	·25	2·10
Newcastle and Carlisle,		2·00
Leicester and Swannington,		1·75
Llanelly and Llandilo,	1·00	1·50
Bristol and Birmingham,		1·43
Durham and Sunderland,		1·40
St. Helens and Runcorn Gap,		1·40
Pontop and South Shields,	·75	1·30
Garnkirk and Glasgow,		1·27
Newcastle and Darlington,		1·25
Edinburgh and Dalkeith,		1·25
Preston and Wyre,		1·25
Taff Vale,	·66	1·16
Manchester and Leeds,	1·00	
Clarence,		·91
Hartlepool,	·75	
York and North Midland,		·75
Great North of England,		·50

The above are not in all cases the average charges, but the maximum charges; as, on some lines, a higher rate is charged for going up hill than for going down hill. Ibid.

Canal across the Isthmus of Suez.

We have several times alluded to the grand project of Napoleon of cutting a ship canal across the Isthmus of Suez to join the Mediterranean and the Red Sea—thus intending to destroy British influence in the Eastern Empire. Since the peace, but particularly the establishing of the overland route to India *via* France, Austria, and Belgium, to Alexandria and Suez, by the indefatigable exertions of Lieut. Waghorn, R. N., F. R. A. S. &c., to whom we are indebted for this expeditious communication, monthly, with our possessions in the

East, the subject has attracted the serious attention of the European powers and eminent engineers—but none more so than England. Several plans of a railway across the desert from Grand Cairo to Suez, 84 miles, were proposed, but the laying down of a line on those arid and scorching sands is considered next to impracticable. A ship canal is that which has always been deemed the most successful, as the Nile—from Atfé to Cairo, 120 miles, and Alexandria to Atfé, by the present canal, 44 miles—offers so many facilities to such a stupendous undertaking; but the Viceroy of Egypt has hitherto evinced considerable opposition to a canal or a railway from Alexandria to Suez, although the offers of a *tollage* were very tempting for his coffers. The late visit of his son, Ibrahim Pacha, to this country,—when he inspected our great manufacturing and mining districts, passed over our principal railway lines, and was able to appreciate the splendid steamers from Liverpool to America, from Southampton to the Mediterranean, the West and East Indies, and from the Thames to the north of Europe, showing our national industry and commercial intercourse with all parts of the globe—had a great influence on the talented and searching mind of that Prince. On his return to Egypt, he laid before his discerning father the observations he made during his short sojourn, and how advantageous it would be to the aggrandizement of that flourishing portion of the Levant, if railways and steam navigation were introduced, not only to facilitate the inland traffic, but especially the transit from Alexandria to Suez. The Viceroy has maturely considered the subject, and is now desirous that this great undertaking should be accomplished, and every assistance rendered on his part to carry it out. It appears the British, French, Austrian, and Russian governments have come to an understanding on this important commercial enterprize; and several eminent engineers—English, German, and French—are at present in Paris, concocting the best plans to commence this grand affair, which will be the means of opening to the manufacturing, agricultural, and mining industry of Europe, India, Australia, Van Dieman's Land, and New Zealand, an expeditious intercourse with each other. One of the stipulations on the part of the British government is, that the canal shall not only be made navigable for merchant vessels, but for the largest ships of war and steamers, to which the other powers have agreed. It is proposed to have a regular line of steamboats between Alexandria and Suez, and *vice versa*—so that a communication will be kept up between the Mediterranean and Red Sea, our possessions in India, and in the fifth quarter of the globe. Should this be accomplished, it will be one of the greatest benefits that could have occurred in the annals of commercial and engineering enterprize; and we have very little doubt but that it can be done, considering the advancement made in science within the last half century, and the disposition on the part of all the European powers to encourage industry, and maintain peace, without those national jealousies which have hitherto been the greatest evil to the commercial enterprize and benefit of mankind at large. The joining the South Pacific across the Isthmus of Panama with the Atlantic, by a ship canal, is another of the daring ideas of the present century, and there is every probability it will ultimately be accomplished by British and French engineers—thereby opening this long-desired communication between the two great oceans.

Lond. Min. Jour.

Cornish Steam Engine Tables.

Table I.

Showing the duty performed by Cornish steam engines for the thirty-three years from 1812 to 1846; also the average and highest duty performed by the best engines in each year.

Years.	Highest Duty Performed.	Name of Mine whose Engine gives highest duty	Average monthly duty of the best Engines.	Average monthly duty of all the Engines reported.	No. Engines reported.	COALS CONSUMED.	
						Av. No. of Bushels of 94 lbs. per month.	Bushel by each Engine per month.
1813	29·76	Stray Park	26·65	19·45	24		
1814	35·00	"	32·00	20·53	29		
1815	34·01	"	30·52	20·52	35		
1816	40·74	Dolcoath	32·04	22·90	32		
1817	44·02	"	41·06	26 50	31		
1818	42·06	"	39·03	25·43	32		
1819	48·05	"	40·00	26·25	37		
1820	48·06	"	41·03	28·73	37		
1821	46·06	"	42·08	28·72	39		
1822	44·16	Consolidated	42·05	28·88	45		
1823	45·98	"	42·12	28·15	45		
1824	46·76	Polgooth	43·05	28·32	45		
1825	53·95	"	45 04	32 00	50		
1826	49·97	Huel Vor	45·02	30·48	48		
1827	67·09	Consolidated	59·67	32·01	47		
1828	87·04	Huel Towan	76·67	37·03	54		
1829	81·99	"	76·23	41·22	52		
1830	77·99	"	75 88	43·35	55		
1831	80·08	"	74·91	44·07	54	81,867	1488
1832	91·35	Huel Vor	79·29	44·04	60	83,480	1346
1833	88·50	"	83·30	46·00	58	88,321	1503
1834	97·85	Fowey Consols	86·25	46·86	57	78,057	1363
1835	95·76	"	91·67	46·45	66	81,979	1225
1836	97·59	"	89·59	45·61	71	101,246	1405
1837	91·98	"	87·68	47·46	70	106,275	1509
1838	91·59	"	84·88	47·84	70	112,631	1566
1839	85·17	Godolphin	82·29	48·88	74	129,801	1740
1840	85·28	Fowey Consols	81·80	49·73	58	203,699	1746
1841	101·71	United Mines	95·23	50·99	51	89,806	1733
1842	107·49	"	99·26	51·62	45	84,862	1848
1843	105·71	"	99·35	55·23	40	72,913	1811
1844	98·72	"	94·89	54·73	35	62,292	1763
1845	96·00	"	91·02	55·64	36	62,148	1715

Table II.

Showing the performances of 12 engines which did the highest duty in October, 1846. The total number of engines reported in that month was 24—the quantity of coals consumed 1884 tons, lifting, in the aggregate, 17,000,000 tons of water 10 fathoms high. The average duty of the whole was, therefore, 51,000,000 lbs. lifted one foot high by the consumption of a bushel of coal.

Mines.	Engines.	Length of stroke.	Load in pounds.	Load per sq inch on piston.	Strokes pr. minute.	Consumption of coal in bushels.	Millions lbs. lifted 1 foot by consumption of 1 bushel of Coals.	Average quantity of water per minute.
Wh. Prosper	Western, 80-inch	9·7	88,096	14·0	4 6	3024	52 6	997·0
Ditto	Roberts's 70-inch	9·75	73,294	14·7	5·0	2364	58·9	
Great Work	Leed's 60-inch	9·0	47,020	12·9	7·0	2243	52·2	166·0
Carn Brea	Sims's 50, 90 in. combined	9 0	42,291	16·7	3·6	920	59·5	—
Poldice	Sims's 85-inch	10·0	80,475	9·9	5·5	2776	57·2	390·0
Ting-Tang	Sims's 60, 100 in. combined	9·0	56,514	18·8	3·5	1584	54·8	226·0
United Mines	Taylor's 85-inch	11·0	97,108	15·5	5·4	3147	81·1	1149·0
Ditto	Eldon's 30-inch	9·0	13,631	16·0	8·2	618	69·2	
Ditto	Loam's 85-inch	10·0	89,320	11·8	4·8	4825	58·0	
Ditto	Hocking's 85-in.	10·0	99,243	14·8	5·8	4244	57 9	
East W. Rose	Penrose's 70-in.	10·0	47,785	11·1	2·9	1050	60·6	627·0
Ditto	Mitchell's 70 in.	10·0	52,516	12·2	5·1	2250	54·8	

Lond. Mec. Mag.

Dimensions of European Churches.

The *Roman Advertiser* gives the following statistics of the capabilities of St. Peter's, as compared with other great churches; allowing four persons to every quadrate meter (square yard):—

	Persons.	Sq. Yards.
St. Peter's,	54,000	13,500
Milan Cathedral,	37,000	9,250
St. Paul's, at Rome,	32,000	8,000
St. Paul's, at London,	25,600	6,400
St. Petronio, at Bologna,	24,400	6,100
Florence Cathedral,	24,300	6,075
Antwerp Cathedral,	24,000	6,000
St. Sophia's, at Constantinople,	23,000	5,750
St. John's, Lateran,	22,900	5,725
Notre Dame, at Paris,	21,000	5,250
Pisa Cathedral,	13,000	5,250
St. Stephen's, at Vienna,	12,400	3,100
St. Dominic's, at Bologna,	12,000	3,000
St. Peter's, at Bologna,	11,400	2,850
Cathedral of Sienna,	11,000	2,750
St. Mark's, Venice,	7,000	1,750

The piazza of St. Peter's, in its widest limits, allowing 12 persons to the quadrate meter, holds 624,000; allowing four to the same, drawn up in military array, 208,000. In its narrower limits, not comprising the porticos or the piazza rusticci, 474,000 crowded, and 138,000 in military array, to the quadrate meter.

London Athenæum.

AMERICAN PATENTS.

List of American Patents which issued in the month of June, 1846,—with Exemplifications, by CHARLES M. KELLER, *Agent for procuring Patents, and late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in Machinery for Measuring Cloth on the Loom ;* Frederic W. Howe, North Chelmsford, Massachusetts, June 6.

Claim.—"I am aware that a roller or cylinder and clock work have been combined, and used for indicating the length of any surface which the said roller or cylinder might be placed and moved in contact with: therefore I do not claim such a combination of mechanism; but that which I do claim as my invention is the combination of the roller or cylinder, and a marking apparatus constructed and applied to it, and operating in conjunction with it, and so as to measure and mark the cloth woven upon the cloth-beam of a loom, substantially in the manner as above specified.

2. For an *Improvement in the Pen or Pencil Case;* Albert G. Bagley, New York, June 6.

The patentee says,—"The ordinary pen or pencil case is constructed with one tube or barrel, and the holder of the pen or pencil, which slides in and out of it. This contrivance is found to be inconvenient, on account of its length, and the object of my invention is to obtain the same length of pen case, when extended, with the advantage of being not more than one-half of the ordinary length, when closed or slided in. This I effect by making my pen case of two tubes or barrels, one sliding into the other, and the pen or pencil holder to slide within them."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode of shortening the pen or pencil case, by constructing it of two tubes or barrels, one sliding within the other, in the manner herein set forth, in combination with the mode described for sliding the pen or pencil holder within the inner barrel of the pen or pencil case."

3. For an *Improvement in the Machine for hulling Clover Seed or Rice;* Martin H. Mansfield, Mifflintown, Pennsylvania, June 6.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner in which the projecting rubbers, in the concave, and on the cylinder, are combined and operate with each other, viz: their backs being broad, (either straight or wedge-shaped,) and their roughened sides tapering to a sharp edge at their fronts, are placed in the concave, and on the cylinder, in such a position that the front edges of the revolving rubbers on the cylinder will pass between the front sharp edges of the rubbers in the concave, the clover seed and rice being hulled by the action of the oblique sides of the rotary rubbers passing between the oblique sides of the stationary rubbers, substantially as herein set forth.

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4. For an *Improvement in Stoves for heating apartments;* Henry Slade, Chelsea, Massachusetts, June 6.

The nature of this improvement consists in applying to the stove a certain combination of eduction flue passages and dampers, by means of which the draught is caused to pass either upwards or downwards, or both upwards and downwards, through the coal or fuel in a state of combustion.

Claim.—"Having thus described my improved stove, what I claim therein, is the combination of the chamber of combustion, and its grate and ash-box, of the two eduction passages and dampers, and two induction passages, and their valves or covers; the whole being arranged and made to operate together substantially as specified."

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5. For an *Improvement in the Method of Impregnating Timber and other porous bodies;* Peter Von Schmidt, Washington, D. C., June 6.

Claim.—"What I claim as my invention, and desire to secure by letters patent, for the purpose of impregnating timber or any other porous substance by any desired fluid, and to encrust or char said wood, in a complete manner, in heated oil, is the following combination of the operations, viz: The steaming of wood in combination of exposing the same immersed in any desired fluid to a vacuum further in combination with the application of high pressure by a hydraulic press pump; and, finally, if required, in combination of charring or encrusting by coal, the impregnated wood in heated oil, as set forth. All these operations are done in one and the same apparatus, as before described in detail in the specification, and illustrated in the drawings. By the different combined actions upon the wood, a perfect impregnation is accomplished, and by the encrusting or charring of the wood in heated oil, the timber so prepared, is more lasting and durable than iron; therefore the combined actions upon the timber, as set forth, have the advantage over all other modes to saturate or kyanize timber which have been practised heretofore.

"I claim the arrangement of the air vacuum, in combination with the funnel, for the purpose and use as set forth."

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6. For an *Improvement in Lamp Burners;* Wm. H. Starr, New York city, June 6.

Claim.—"I do not claim to have invented a new lamp, nor do I claim to have invented any of the parts herein described, nor any exclusive use thereof, irrespective of the manner in which I have constructively combined them for these purposes.

"But I do claim as new, and of my own invention, and desire to secure by letters patent, the constructing lamp-burners, with the slide cylinders, and perforated cylinder, to carry the fixed intermediary capillary wick between them, so that these three parts act in combination to maintain a continuous supply of combustible matter to the burning wick, including the variation shown, and otherwise, substantially as herein described and shown."

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7. For an *Improvement in the Danforth Cap Spinner;* Jacob Peters, Kensington, Philadelphia County, Pennsylvania, June 6.

Under this arrangement, the whirls and bobbins do not traverse up and down with the traverse rails and spindles, but retain their positions as related to the cylinder, or drum, the spindles sliding through the tubes, and through the neck rail and cap, and communicating the traversing motion to the caps only, which rise and fall to distribute the thread upon the bobbins.

Claim.—"Having thus fully described the nature of my improvements in the cap spinner, what I claim therein as new, and desire to secure by letters patent, is the arranging the cap-spindle and bobbins of said machine in the manner herein set forth, by which arrangement the whirls and bobbins are not subjected to the traverse motion, but are merely made to revolve by bands from the cylinder or drum, in the manner set forth, whilst the traversing motion is communicated to the caps alone."

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8. For an *Improvement on the Bat-Wing Burner, for burning gas;* Joseph Battin, Philadelphia, Pennsylvania, June 6.

The patentee says,—"My improvement consists in the particular manner in which I cut two slits in the end of the burner, for the issuing of the inflammable gas, said slits having that relative position which will cause the two broad thin volumes, or sheets of flame produced by the ignited gas, issuing from them, to unite soon after they leave the openings, and to form one combined sheet of flame, the effect of which is, that the amount of light obtained from a given volume of gas is increased nearly or quite one-third."

Claim.—"Having thus fully described the nature of my improvements in the bat-wing gas-burner, what I claim therein as new, and desire to secure by letters patent, is the cutting of two slits in the end of such burner, the relative situation of which slits is to be such as is herein designated; and such as, by their proximity and position, will cause the flames from each slit to unite immediately after their escape therefrom, and form one combined flame; by which arrangement, I obtain the desirable result herein set forth."

9. For an *Instrument called the Saw Dresser, for re-cutting the teeth of saw-mill saws;* Apollos B. Spencer, Newton, Pennsylvania, June 6.

A frame is so formed that it can be clamped to the saw, with a rest or die, that rests against the edge of a tooth, and made adjustable to suit different sizes. A cutting burr is hung in a secondary frame, which slides in the clamped frame, at an angle to correspond with the slope of the teeth, so that by sliding the secondary frame, and rotating the burr, the teeth will be cut.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the burr, guided and operated, as herein described, with the movable rest or die, on which the saw rests when cut, and the sliding fastening, for the purpose and use, as a saw dresser, as described in the specification, and illustrated in the drawings."

10. For an *Improvement in Machinery for Boring and Mortising Hubs;* George Nichols, assignee of J. J. Greenough, Bridgeport, Connecticut, June 13.

The patentee says,—"The nature of my improvement consists in connecting an auger with the carriage on which the hub is fixed, so as to move with it, and bore into the hub at the same time the chisel is mortising; said auger or bit being driven by the same shaft that moves the chisel, so that both operations can be conducted at the same time, by which the work can be greatly facilitated."

Claim.—"Having thus fully described my improvement, what I claim therein as new, and desire to secure by letters patent, is the combination of the mortising and boring apparatus, in the manner and for the purpose set forth."

11. For an *Improved Brake, for Retarding the Motion of Sleds, Sleighs, &c.;* John Du Bois, Jr., Cascade, Pennsylvania, June 13.

This invention consists in securing the tongue or pole, in the roller, in such a manner as to allow it to play freely inwards and forwards, in a mortise through the same, and, in connecting the tongue to a couple of scrapers placed on the inner sides of each runner—near their middle—so that when the tongue is pressed back, it forces the points of the scrapers against the snow or ice of the road, and thus retards the sleigh.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the retarding the motion of sleds or sleighs in descending inclinations, by means of self-acting and self-regulating scrapers, attached to the runners, and connected to the tongue of the sled by means of the acute angled elbow, connecting bars, and hammer strap; the whole combined and operating substantially in the manner and for the purpose herein set forth."

12. For an *Improved Parlour Cooking Stove;* Rensselaer D. Granger, Albany, New York, June 13.

Claim.—"I claim locating the pipe communicating from the body of the stove to the elevated oven between the two back boilers, so that its front lower edge shall be contiguous to the fire, *in combination* with the division strips, and the damper, arranged and operating as herein described and shown, viz: so as to form one centre flue beneath the connecting pipe, which flue may be closed at pleasure by the damper, in order to throw the heat through two side flues, and cause it to pass under the rear boilers before it escapes into the connecting pipe.

"I further claim forming the connecting pipe of the horizontal section, herein shown and described: that is to say, having the pipe made broad on its front side, next the fire, for the purpose of obtaining a large capacity of pipe; and also to bring the broadest portion of its section in contiguity with the fire, and accommodate the boilers in the rear."

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13. For an *Improved Plough or Machine for Removing Snow from Rail Road Tracks;* Joseph A. Gregg, Derry, New Hampshire, June 13.

Claim.—"Having thus explained my invention, what I claim as my improvement is the combination of two or more ploughs; that is to say, the arranging two or more ploughs *above* one another, in combination with arranging each plough in advance of the one directly below it, in order that the snow, as it rises, or is thrown from the rear or back part of each mould-board of the inferior plough, may clear itself therefrom, without being obstructed by the mould-board of the plough directly over it; the same being substantially as above set forth."

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14. For an *Improvement in the Self-acting and Self-adjusting Carriage Brake;* Z. C. Robbins, Washington, D. C., June 13.

The patentee says,—" The nature of my invention consists in constructing a carriage brake in such a manner, that, when it is desired to back the carriage, the brake can easily be disconnected from the shafts of the same, and the rubbers prevented from acting on the wheels; and the moment the shafts are drawn forwards, the brake resets itself in its proper position for acting on the wheels at the first hill the carriage descends."

Claim.—" Having thus fully described my self-acting and self-adjusting carriage-brake, what I claim as my invention, and desire to secure by letters patent, is the combination of the draught-shafts, with the brake-shaft, by means of the connecting rod and lever so operating with each other that, by lifting the rear end of the connecting rod, the draught-shafts can be forced back, without acting on the brake-shaft; and when the shafts are drawn forward again, the connecting rod resets itself, making a perfect connexion between the draught-shafts and brake-shaft, substantially as herein set forth."

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15. For an *Improvement in the Method of Breaking, Fleshing, and Unhairing Hides;* George Welty, West Newton, Pennsylvania, June 13.

The patentee says,—"The nature of my invention and improvement consists in a new mode of working hides by power machinery, instead of hand: that is to say, taking the hides, after being properly soaked, and subjecting them to the action of a series of parallel serrated plates, (for breaking and fleshing the hides,) placed on the periphery of a revolving cylinder, arranged immediately above a revolving drum, for sustaining, raising, and carrying forwards the hides, between the cylinder and drum—the hides being introduced from an inclined table and roller—the effect of said serrated plates being to break and flesh the hides, as they pass between the said cylinder and drum."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the before described mode of fleshing, unhairing, and scouring hides, and setting sole-leather, as described, by means of the aforesaid combination of the cylinders and drum, arranged and operated in the manner set forth."

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16. For a *Self-acting Carriage Break;* John Du Bois, Jr., Cascade, Pennsylvania, June 13.

The patentee says,—"The nature of my invention consists in extending the hounds, which stay and support the pole of a vehicle, back a sufficient distance beyond the forward wheels of the same, to enable me to secure to the rear ends of the hounds an adjustable sway bar, to each end of which I secure breaks or rubbers. The bar to which the rubbers are attached, is connected to the rear end of the pole by means of levers, &c., in such a manner that, when there is any pressure of the vehicle forward, the horses, in pressing back upon the pole, will press both rubbers uniformly against both forward wheels—the rubbers always acting at right angles with the pole, whether the pole be in a line with the body of the vehicle or otherwise."

Claim.—"Having thus fully described the construction and operation of my self-acting brake, as applied to the forward wheels of wagons, or other four-wheel vehicles, what I claim therein as new, and desire to secure by letters patent, is the placing on the rear ends of the extended hounds, which support the pole, an adjustable movable sway bar, having brakes or rubbers attached to each of its extended ends, in a position to act on the forward wheels of a wagon or carriage when its forward motion is retarded by the pole—the adjustable sway bar being connected to and operated by the pole, by means of connecting rods and levers; the whole combined and operating substantially in the manner and for the purpose herein set forth."

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17. For an *Improvement in the Corn Sheller;* David S. Hollister, Baltimore, Maryland, June 13.

We are under the necessity of omitting the claim, as it refers to, and is wholly dependant on, the drawings, and we do not deem it sufficiently important to justify the publication of them.

18. For an *Apparatus for Holding the Plates in the Photographic Art;* A. S. Southworth, and J. J. Haws, Boston, Massachusetts, June 13.

This is an apparatus for holding the plates during the process of polishing their surfaces. The plate is held by adjustable plates that project from the surface of the block, about half the thickness of the plate to be polished, so that they gripe and hold the plate by the edges, instead of extending over the edges, as heretofore. The patent, however, is not granted for this, but for the manner of suspending the block, that it may yield to the motions of the polishing instrument; and, as the character of this device is pointed out in the claim with sufficient clearness, we will omit any farther description.

Claim.—"Having thus described our apparatus for holding plates to be polished, what we claim therein as our own invention, and desire to have secured to us by letters patent, is the supporting the plate holder on a bar constructed for holding the same firmly, substantially as herein above described, and suspended by right angular arms, projecting upwards from its ends, and hung upon pivots,, as set forth, so that the top of the plate in the holder will adapt itself, as it were, to the face of the polishing tools when touched by the same, as herein above set forth."

19. For *Improvements in Machinery for the Manufacture of Cordage;* B. F. Adams, Bristol, Massachusetts, June 13.

The claims cannot be given by reason of their entire dependance on the drawings, which are numerous.

20. For *Improvements in the Machine for Cutting Book-binders' Boards;* Geo. S. Schofield, Philadelphia, Pennsylvania, June 16.

This machine is for cutting book-binders' boards into strips, by means of two sets of cutter wheels, placed on two shafts, one above the other, so that the boards pass between the two sets to be cut. On each side of these cutter wheels, there is a set of feed rollers, one to take the boards from a feeding table, (provided with a slide, to insure the proper presentation of the boards,) and deliver and force them through between the cutters, and the other set to receive and help to draw them through.

Claim.—"Having thus fully made known the manner in which I construct the machine herein described, I do hereby declare that I do not claim the use of circular cutters, of feeding rollers, or of a feeding table, as in themselves new; but what I do claim as new, and desire to secure by letters patent, is the manner in which I have arranged and combined the respective parts, so as to constitute a new, useful, and improved machine for the cutting of book-binders' boards, &c., into strips or regular widths—that is to say, I claim the combining of the series of circular cutters with the two pairs of feeding rollers, and with the table—the wheels being arranged and operating substantially in the manner herein set forth."

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21. For *an Improvement in the Method of Securing and Setting the Bit in Hand Planes;* Leonard Bliss, Truxton, New York, June 16.

The bit is secured by an eccentric roller placed in the throat of the plane, just above the bit, and provided with a handle, so that, by turning this, the eccentricity will effectually secure the bit, and avoid the necessity of hammering, as when the wedge is used.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of securing and setting plane irons or bits by means of an eccentric roller extending across the face of the bit, and turning in boxes in the cheeks of the stock, as herein described."

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22. For an *Improvement in the Spring Stirrup;* Abraham Pawling, Philadelphia, Pennsylvania, June 16.

One side of the stirrup is jointed to the lower bar, as in the well-known mode of making spring stirrups, but, instead of depending on the force of the spring alone, to keep this part closed, the spring, which bears up against the underside of the shoulder of the joint, is connected with a piece on the upper surface of the bottom bar, so as to draw it down on to the upper shoulder of the jointed part, which has a rounded notch to receive a corresponding projection on the under surface of the upper piece, so that this rounded catch must be lifted before the stirrup will open.

Claim.—"Having thus fully described the manner in which I combine and arrange the respective parts of my spring safety stirrup, I do hereby declare that I do not claim as new the so forming and connecting one side of the bow of a stirrup with the other parts thereof, as shall allow it to open for the purpose of disengaging the foot therefrom, this having been before done; but what I do claim as new, and desire to secure by letters patent, is the manner in which I have effected this object, by the combined action of the piece, the spring, and the detachable side; these parts being formed and operating substantially as herein fully made known."

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23. For an *Improvement in Spring Mattrasses;* Frederick Forst, Philadelphia, Pennsylvania.

The improvement patented, consists in making the length of the lower frame in two parts, the side pieces of which, where they come together, are sloped down and connected together by strong webbing or other suitable material, and then the covering, properly stuffed, is attached to the upper edge of the two frames, and the connecting webs or other ligaments, which form the hinges, to admit of bending or turning one half on to the other.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is making the frame to which the springs are attached in two parts, connected together by means of strong webs, straps, or other substances, substantially similar in combination with the mattrass as herein described, whereby mattrasses attached to a frame, and resting on springs, may be folded or turned up for moving them, and for the ease of invalids, as fully described above."

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24. For an *Improvement in the Horse Power:* Jesse Fitzgerald, New York City, June 16.

The horse lever turns on the shaft of the main wheel, and is connected with the wheel to carry it around, by a friction brake, to avoid the breaking of the machinery by any sudden starting of the horse, or sudden stoppage of the machinery. And this brake, which constitutes the ground of the claim, is made in the following manner: The main wheel has cogs on its inner periphery, in which take the cogs of a pinion, the shaft of which passes through the horse beam, and, above the beam, this shaft has a wheel, against the periphery of which friction is made by a strong spring attached to the beam.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of a pinion and wheel, with the main wheel, for the purpose of producing friction, (by means of a spring, or other pressure,) sufficient to hold partially or entirely the lever in its place, for the object within described.

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25. For an *Improvement in the Lifting Pump;* John Renfrew, Fayette, Pennsylvania, June 16.

The patentee says,—"It is well known that, in the common lifting pump, all the force necessary to lift the column of water, pump-rod, &c., must be exerted during the upward stroke, the return stroke being accomplished by the weight of the rod, &c. This is admitted to be defective. The object of my improvement is to equalize, or nearly, the force required to work the pump, which I effect by attaching a hollow float to the pump-rod, above the piston or pump-box, the buoyancy of which, in the water, will aid in giving the upward stroke, and, from its capacity, will reduce the area of the column to be lifted."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of a float or air-tight vessel within the barrel of a lifting pump, and attached to the piston rod, for the purpose and in the manner substantially as herein described."

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26. For an *Improvement in the Blacksmith's Tuyere;* Charles W. Grannis, Collins, Erie County, New York, June 16.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is causing the blast to descend, and then ascend, before leaving the tuyere, by curving the orifice down, and then enlarging it upwards, by which I obtain an elevated blast, and prevent the tuyere from clogging, in combination with a valve placed below the draught, so that on elevating it, the draught will be contracted from below, as hereinbefore specified."

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27. For an *Improvement in the Fanning Mill for Cleaning Grain;* Daniel Clow, Port Byron, New York, June 16.

The screens are connected with the shoe by being let into grooved plates, connected with the side plates of the shoe by adjustable screws, and the two side plates of the shoe are connected together by screw-rods and nuts, for the purpose of securing the screens in place, when put in the grooves.

Claim.—"Having thus fully described the construction and operation of my improvement in the fanning-mill, what I claim therein as new, and desire to secure by letters patent, is the adjustable groove plates, for confining the screens to the sides of the shoe, and, in combination therewith, the manner of securing the screens firmly in any desired position by the rods and screw-nuts, substantially in the manner and for the purpose herein set forth."

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28. For an *Improvement in Suction and Force Pumps;* Samuel K. Sharpe, assignee of F. B. Hyatt, Maysville, Kentucky, June 16.

Claim.—"Having thus fully described my improved pump, what I claim therein as new, and desire to secure by letters patent, is the combination of a forcing and a lifting pump, substantially as herein described, so that the lifting pump can be formed into a surrounding air-chamber for the purpose set forth, by means of a cap valve, by which the top can be made tight without passing the rod through a stuffing-box; the whole being arranged and combined substantially as above specified."

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29. For an *Improvement in the Fabric for Making Ladies' Skirts;* David Hough, Jr., New York, June 16.

Claim.—"Having thus fully described my improvements and their application, what I claim as new, and desire to secure by letters patent, is the employment of bands of sisal or Manilla hemp, with a fabric of cotton or suitable cloth, so as to form a series of horizontal springs around a skirt, while the skirt is left perfectly pliable in its length, and can be washed without removing the bands: constructed and combined in the manner and for the purpose described."

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30. For an *Improvement in the Double Oven Stove;* Wm. Cobb, Albany, New York, June 16.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the connecting the upper and lower dampers by a lever, in such a manner that, when one damper is opened, the other will be shut, in combination with two ovens, placed one above the other, with flues between and around them; the whole being arranged and operating as herein described and shown."

31. For an *Improvement in the Machine for Cleaning Grain;* Frederick A. Stuart, Catharine, New York, June 20.

"This improvement is designed to separate the straw and chaff from the grain, and convey them off together, through a blast of wind from a common winnowing machine, to an inclined spout that conveys it to a receiver."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the vibrating shaker, with the inclined swinging trough, as described, and for the purpose set forth."

32. For a *Machine for Putting Boots and Shoes on the Last;* Silas Hart, New Haven, New York, June 20.

The patentee says,—"The nature of this invention and improvement consists in contracting and expanding the arms containing the jaws for gripping the edges of the upper of the boot or shoe, by means of a slide that embraces or encircles the arms, said arms being moved towards or from the last, simultaneously with the operation of turning the male screw in a female screw, in the centre of the nut, to which they are connected, by which the angle of the arms with the screw is diminished by lasting the upper, and increased in unlasting it, by reversing the operation of the screw; thus removing the objections existing in the use of the machine, where the arms are expanded and contracted by a separate screw, managed at right angles to the main screw, and possessing the advantage of drawing the edges of the leather inward towards the shank, and outward towards the side simultaneously, at the single operation of turning the screw against the last."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is combining the screw and slide with the jaws, in the manner, and for the purpose described.

"I also claim the movable section, in combination with the screw, as described."

33. For an *Improvement in the Valves of Steam Engines;* H. Olney, J. H. Whelpley, & D. G. Raven, Gouverneur, New York, June 20.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the method of inducting and educting steam to and from the cylinder of one engine, by means of a hollow piston rod in two parts, connected to and united by a piston, in which are placed induction and eduction slide-valves, operated by thin projecting ends sticking against the heads of the cylinder, as the piston approaches them in performing its reciprocal vibrations—the induction valve being in connexion with one portion of the piston rod, and the eduction valve with the other portion of the same; the whole combined and operating substantially in the manner herein set forth."

34. For *Machinery for Making Wrought Iron Cannon;* Daniel Treadwell, Cambridge, Massachusetts, June 20.

We are under the necessity of omitting the claims in this instance, as they depend entirely on the drawings; but it is our intention to publish the drawings in a future number, together with so much of the description as may be necessary to a clear understanding of this invention, which is deemed important from the fact that the inventor has made wrought iron cannon for the government, on this plan, that have stood every test to which they could be subjected.

35. For an *Improvement in the Horse Power, for Driving Machinery;* J. R. Remington, Lowndes County, Alabama, June 20.

This invention may truly be called a horse power, for it consists of an arrangement of parts for whipping the horses, when they do not move fast enough, the mechanism that operates the whips, being governed by a regulator or centrifugal governor.

Claim.—"Having thus fully described my improvements, what I claim therein as new, and for which I desire to secure letters patent, is the employment of my apparatus for whipping or checking the horses, by means of the regulator, substantially in the manner and for the purpose set forth."

36. For an *Improvement in the Wheat Fan, for Cleaning Grain;* S. M. Yeaman, Elizabethtown, Kentucky, June 20.

The patentee says,—"The nature of my invention consists in dispensing with the shoe used in common fans, and causing each of the riddles to act independently of the others, and in opposite directions, thus equalizing the vibrations, and preventing the machine from choking."

Claim.—"Having thus fully described my invention, what I claim therein as new, and desire to secure by letters patent, is the mode of operating the riddles, sieve, and finger-bars, and combining them with the grain fan, substantially in the manner described, so that each shall move independent of the others, and their motions be antagonistic, while a much greater surface of riddle can be embraced in the same sized machine than is possible in the ordinary mode of construction.

"I also claim, in combination with the above-named parts, the feeding apron, as hereinbefore described."

37. For an *Improvement in what is known as the "Old Philadelphia," or Ten Plate Stove;* William Shaw, Albany, New York, June 27.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode of forming and arranging the flues of my stove, as herein set forth and described, viz: by constructing my oven bottom with trough-like depressions or sunk flues, (to be covered with a false bottom,) the part of the plate between said flues serving to radiate directly into the oven the heat generated at the bottom of the fire-grate. Also, the mode of constructing the front oven-plate, with the attached descending flues occupying a part thereof, the remaining portion allowing a direct radiation from the back of the fire-box into the oven; and further, the so constructing the back oven-plate as to form, in connexion with the *false* back, two open flues, with a closed or dumb flue between them, likewise radiating into the oven heat derived from the lower side of the fire-grate; the whole system being, as it were, suspended within the stove, so that the bottom and rear flues, which convey heated air from *above* the fire, are not in any part formed by the exterior plates of the stove, but are separated from them by a stratum of air, heated by radiation from the bottom of the fire-grate."

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38. For an *Improvement in the Filter;* Wm. Bullard, assignee of Royal E. House, New York City, June 27.

This is a filter and cock combined,—the pipe and spout are one, and in the tube thereof there is an oblique partition, with a hole through the pipe on each side of the partition. This part of the pipe is surrounded by a case that is fitted by collars, &c., to turn thereon, and this case is divided into two concentric chambers, by a filtering medium. The water to be filtered, passes along the pipe until it strikes the partition, it then passes through one of the holes, and through a tube to the outer chamber, and, after passing through the filtering medium, into the inner chamber, runs in through the other hole, into the spout on the outer side of the partition. By turning the case on the tube, the supply holes are closed, and the flow of water stopped.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the partition pipe with the chambers, by means of the tubes, in the manner and to produce the effect above pointed out."

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39. For an *Improvement in the Straw Carrier, for Separating Grain from Straw;* Russell Tomlinson, Jackson, Michigan, June 27.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is hinging the slats where they are attached to the chain or belts of the straw carrier or separator, by which means the slats are nearly closed when on the upper side, and open when on the under."

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40. For an *Improvement in the Horse Power;* Daniel Cary, Clarkson, New York, June 27.

Claim.—"Having thus fully described the manner in which I construct my horse power, what I claim therein as new, and desire to secure by letters patent, is the special arrangement and combination of the gearing, as herein set forth; said gearing consisting of a single large wheel, driving two pinions, on the shafts of two horizontal wheels, which horizontal wheels gear into two pinions on the line shaft, there being a bridge to admit of the line shaft, the whole arrangement being substantially the same with that herein represented and made known."

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41. For an *Improvement in the Machine for, and in the Method of, Measuring for the Cutting of Garments;* Conrad Kile, Nashville, Ohio, June 27.

We omit the claims in this instance, as they could not be understood without the drawings to which they refer.

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42. For an *Improvement in the Fire Ladder;* James Cox, Brush Valley, Indiana, June 27.

Claim.—" Having thus fully described my improvements, I wish it to be understood that I do not claim a ladder made of sliding sections, nor do I claim mounting said sections on wheels, as these things have been done before; but what I do claim as my invention, and desire to secure by letters patent, is the method of elevating the upper sections, by means of cords attached to them, and to the parts below, so that, by raising the lower movable section by the windlass, each of the sections above shall be drawn out a proportional distance, in the manner, and for the purpose described."

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43. For an *Improvement in the Stove for Heating Apartments;* Saml. Pierce, Peekskill, New York, June 27.

The patentee says,—" The nature of my invention consists in providing the sides of the fire-place with a chamber on each side, provided with apertures to receive atmospheric air from the room, which, after being highly heated by circulation, is discharged in small jets from one of them, through apertures into the fire chamber, above the fuel, to consume the combustible gases evolved from the fire, while in a highly heated state, and from the other, below the grate, to supply heated air for the combustion of the fuel; and also, in combining therewith, a damper or register, to admit cold air under the grate to regulate the combustion."

Claim.—" What I claim as my invention, and desire to secure by letters patent, is combining with the fire chamber of a stove a chamber or chambers, pierced with small holes, to discharge the air that is highly heated in passing through them below and above the fire, for the purpose and in the manner substantially as herein described. And I also claim, in combination with this mode of supplying heated air to the fuel and products of combustion, the damper or register, for admitting cold air to the fuel when desired, to regulate the combustion, as described.

44. For *Improvements in the Kitchen Range;* George E. Waring & Alexander S. Walcott, Stamford, Connecticut, June 27.

Claim.—"Having thus fully described the manner of constructing and arranging the respective parts of the improved kitchen range, what is claimed as new therein, and desired to be secured by letters patent, is the particular manner of arranging and combining the fire chamber, the descending flue in the rear thereof, duly lined as described, and the flue space under the oven, so that the heated air shall operate first on the bottom plate of the oven; also the manner of arranging the partition, and the valve or shutter, so as to compel the heated air, when allowed to pass from the fire chamber to the exit pipe, to operate with its full intensity on the cooking utensils, that are placed in the compartment over the oven; and likewise the employment of the ridges or points on that part of the bottom plate of the range that is immediately under the bottom oven plate, in the manner, and for the purpose set forth."

45. For an *Improvement in the Winnowing Machine, for Cleaning Grain;* D. A. Church & Smith Church, Friendship, New York, June 27.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the forming a screen, or series of screens, of thin, broad pieces or strips of wood or metal, united longitudinally and transversely with each other, the upper edges of the longitudinal strips being elevated above the upper edges of the transverse strips, substantially in the manner, and for the purpose set forth."

The object of placing the upper edge of the longitudinal strips above the cross strips, is to prevent the straw and chaff from falling into the spaces between the cross strips, and to furnish straight and smooth ways for the straw to slide on, when acted upon by the blast of wind.

46. For an *Improvement in the Radiating Stove;* H. D. & J. McK. Fouse, Baltimore, Maryland, June 27.

Claim.—"Having thus fully described our improved radiating stove, what we claim therein as new, and desire to secure by letters patent, is the forming the furnace thereof of two casings, with an ascending flue space between, and the combining the same with the enclosing radiating casing, substantially in the manner, and for the purpose set forth."

47. For an *Improvement in the Ever Pointed Pencil;* A. G. Bagby, assignee of John Durant, New York City, June 27.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode herein set forth, of forming a bottle or receptacle for surplus leads in the inner cylinder, within which the traveler works, by introducing slips of sheet metal or tubes, to keep the leads from obstructing the passage of the traveler, and to form compartments for the leads to be deposited, in combination with a cap, to screw or slide on the end of the cylinder, so as to keep the leads in the compartments."

48. For an *Improvement on a Machine for Crimping Boot Fronts;* Henry S. Davis, Westernville, New York, June 27.

Instead of griping the leather by the edges, and stretching it, it is scraped or rubbed down, by two jaws that move on each side, the teeth of which are formed at such an angle as to correspond with the general form of the boot mould, so that, in rubbing, the teeth tend to spread out the leather in all directions, and gradually to bring it to the form of the mould.

Claim. "I claim the invention of the teeth or scrapers, as constructed by me, on the inside of the jaws, and conformed exactly to the angle of the jaws and mould."

49. For *Improvements in the Apparatus for Generating Gas from Rosin or Oily Substances, by the use of Iron Balls;* Amaria Pierce, Philadelphia, Pennsylvania, June 27.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination, use, and arrangement of two retorts, one in the inside of the other, fastened and secured as described, for the purpose to generate gas from rosin, or any other oily substance, as set forth; which rosin or oily substance is introduced in the space between the heated (large) retort and the inside heating retort, as described in the specification, and represented in the drawing.

"I claim the use and combined arrangement to keep up a constant and uninterrupted current of water through the condensers, for the purpose of cooling and condensing the gas, which is arranged in the following manner: The supply barrel is supplied by the pump, from the reservoir; the current of water passes through the supply barrel into the worm-shaped gas cooler, through the supply pipe, and then through the warm water pipe, into the first coolers; and, lastly, returning the heated water by the return pipes, again into the reservoir, to renew the circulation, as described in the specification.

"I claim the combining the armature or jacket with the retort, in the manner described, for the purpose to enclose and secure the lower parts of the large retort from the destructive action of the fire. I claim the arrangement of the tar trap, being in the inside of the tar chest, attached to the lower extremity of the conducting gas pipe, for the use and purpose as described above."

50. For a *Vent Plug or Cork, for bottles and other vessels containing fermenting liquids;* M. Vasser, Poughkeepsie, New York, June 27.

The patentee says,—"It is known that vessels containing fermenting liquors frequently burst, from the great pressure of the gases generated by the fermentation within, and, with the view to prevent this, I have invented a vent plug, or stopper, (to be applied to all such vessels,) provided with a cap that covers the aperture or vent, which cap is connected and held down by means of a strip or strips, or threads of India rubber, attached to the lower end of the plug or stopper, and passing up through the aperture thereof, so that the vent is kept air-tight by the tension of the India rubber, until the pressure of the gases within becomes so great as to endanger the safety of the vessel, and superior to the tension of the India rubber, when the cap is lifted by the escaping gases, to relieve the vessel, and then closed again. And, as the cap cannot be opened, until the pressure of the gases becomes greater than that of the atmosphere, added to the tension of the India rubber, it is evident that atmospheric air cannot enter, to vitiate the liquid."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the spring cap, in combination with the vent-plug or stopper, as herein described."

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51. For *Improvements in Power Looms;* Warren Dutcher, Bennington, Vermont, June 27.

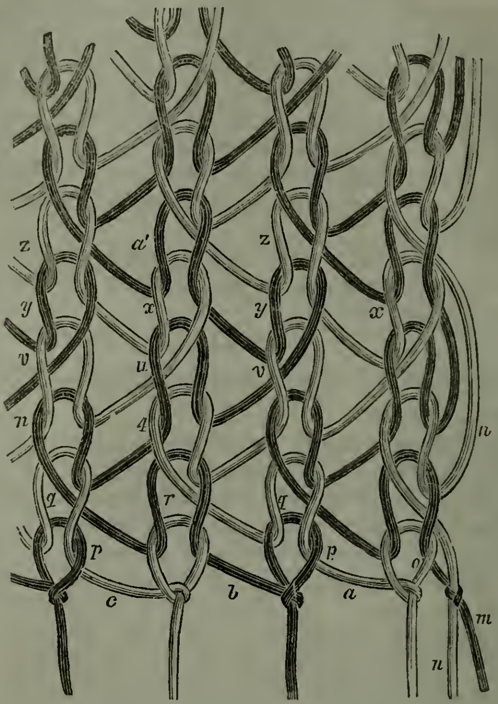
The nature of this invention "consists in connecting each driving shaft with the shuttle box, by means of a joint-link, jointed to the shuttle box, and to the staff, about the middle of its length; the staff also rests against a roller near its lower end, to admit of its moving up and down, and to answer the purpose of a fulcrum, for drawing back the staff, by means of a strap attached to a spring, and to the end of the staff below the roller. The lower ends of the two staffs being connected by the same spring, the tension of which is so regulated, that, when one staff is thrown back, it has strength enough only to carry back the other staff about half way, where it remains until the shuttle is driven back, which distends the spring and causes this staff to move back, as the shuttle reaches it, and which, therefore, gradually arrests it."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is combining the driving or wag staffs with the shuttle boxes, by means of the joint-links, as herein described, for the purpose of causing the end that drives the shuttle without a picker, to move parallel with the race board, or nearly so, during its vibration, substantially as described.

"And I also claim connecting the lower end of the two staffs below their fulcra, by means of a spring having an intermittent action for drawing them back, in combination with the application of a positive motion above, for driving the shuttle, whereby the returning staff aids in arresting the momentum of the shuttle, substantially as herein described."

52. For an *Improvement in Warp Net Fabrics;* James S. Glover, Ipswich, Massachusetts, June 27.

The accompanying drawing, together with the claim, will give a perfectly clear notion of this fabric to the reader.



Claim.—"Having thus fully described my invention, that which I claim is the above specified mode of looping and interlooping, or interweaving, the several warp threads in opposite directions: that is to say, the advancing each thread towards the left and looping it twice, and passing each of the loops so formed through loops of the adjacent thread on the left; then reversing the direction of each thread, or carrying it towards the right, and forming two more loops upon it, and introducing said loops respectively through two loops of the thread immediately adjacent on the right, and so on throughout the whole fabric to be woven.

"I also claim the above described manner of forming the selvages, or combining or uniting the selvage threads with one another, and the main warp threads, the same being represented in the drawing."

53. For a *Machine for Weaving Nets;* James McMullen, Baltimore, Maryland, June 27.

This machine, from the very nature of the operation it is intended to perform, is very complex, and the mechanism intricate. The drawings are numerous, and the specification covers some sixteen folio pages; and, as the claims refer to, and could not be understood without, the drawings, we are under the necessity of omitting them. We will endeavor shortly to condense the description and drawings, to give our readers some notion of this ingenious piece of mechanism."

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54. For an *Improvement in the Method of Making Ploughs by Swedging;* Harvey H. May, Galesburg, Illinois, June 27.

The patentee says,—"The nature of my invention consists in forming mould boards, shares, ties, (to connect the mould board and share,) and plough posts or standards, by means of a press, having dies or swedges, (one set for right hand, and one set for left hand ploughs,) in which the mould board, the share, the ties, and the post, have their place, and are adjusted by perpendicular rods, while being formed. To facilitate the fitting and putting together the plough, I make the upper die stationary in the press, while the lower die is movable, and is elevated with great force, causing the part of the plough in the press to conform to the upper die. The upper die I call the *mould,* and the lower one I call the *follower.*"

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of forming mould boards, shares, ties, plough posts, (or standards,) of wrought ploughs, by means of dies or swedges, (mould or follower,) in combination with rods or projections to determine the appropriate position of each piece in the press while being formed, as herein described."

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55. For a *Machine for Weighing, Packing, and Pressing;* Gilbert D. Jones, New York, June 27.

This invention is for the purpose of weighing, packing, and pressing spices, coffee, drugs, flour, and other materials which are usually put up in packages.

The patentee says,—"The prominent features of this machine consist, first, of means to convey the spices into a 'counter balance scales,' which are so contrived, by the balance end of the latter being connected with a cord, which passes over a pulley, to the sliding door of a hopper, as to admit of any weight of spices that may be required for the ordinary description of packages used in business. Second, the mode of dumping the spices from the scales into the package paper, which has been previously folded and sealed at one end. Third, an endless chain of moulds, of suitable form and dimensions, to receive the package paper. By the horizontal movement of this endless chain, the packages in the moulds are successively brought to their respective places, to receive the spices from the 'counter balance scales,' to be packed and pressed, and, finally, in a finished shape and condition, ejected from the moulds, into a basket or receiver."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the endless chain of moulds, open at both ends, and stationary bed plate, combined with the succession of differently formed presses or pistons."

Improvements added to existing Patents in the month of June, 1846.

1. Lucius Stebbins, Hartford, Connecticut, June 16. Improvement added to letters patent granted to him on the 12th of March, 1840, for a *Machine for Coloring Maps, Charts, or other Prints.*

For a description of the original, the reader is referred to this journal, vol. 1, third series, page 332.

Claim.—"Having thus fully described the nature of my additional improvements in the apparatus for coloring maps and prints, what I claim therein as new, and desire to secure by letters patent, is the attaching the stencil plates or theorems to a wheel or reel, in such a manner as that they may revolve vertically, and pass over and under the table upon which the map or print is placed, substantially as herein fully made known, the apparatus remaining in all other respects the same with that described in the specification to which this is supplementary."

List of American Patents which issued in the month of May, 1842, *with Exemplifications, by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in the Method of Disconnecting Horses from Carriages;* George Kintzi, Exeter, Pennsylvania, May 4.

The patentee says,—"The nature of my invention consists in providing the back plate part of a swingle tree with springs, whose thinner ends come to lay in about the centre of said tree, under a turning plate, the turning of which permits the escape of the springs from over the swingle tree, and liberate it."

Claim.—"What I claim as my invention, is the mode herein described, of releasing horses from a carriage, by means of the springs which are connected with the swingle tree, by the turning plate, as described."

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2. For an *Improved Mode of Applying the Escape Steam of Steam Engines to Distilleries, Propelling Machinery, &c.;* Geo. & Geo. W. Davis, Canal Fulton, Ohio, May 4.

The patentees say,—"The nature of this invention and improvement consists in combining and arranging certain plates, valve seat, valves, and valve box, in such a manner as to produce an apparatus, to be applied to the steam cylinder of an engine, instead of the usual escape pipe, by which the main body of the steam may be applied to various useful purposes, without producing any reaction or resistance on the piston, by the steam which remains in the cylinder, after the main body of the steam has been let off, and applied to the above mentioned purposes."

Claim.—"We do not claim applying the escape steam of the steam engine to any particular purpose, but that which we do claim, is the before described method of applying the main body of the escape steam of the engine to useful purposes, and then conducting the remaining portion of said escape steam to the condenser, or into the air, to prevent resistance to the piston in the cylinder, which is thus rendered entirely clear of all obstruction, in the manner herein set forth, or in any other mode substantially the same."

3. For an *Improvement in the Churn;* Roderick Goodwin, North Bergen, New York, May 4.

Claim.—"What I claim as my invention, and a useful improvement in said machine, is the shape, position, and arrangement, and relative situation of said floats, so attached to said arm as aforesaid, and as proposed to be used in connexion with the rest of said machine; by which, when it is in operation, a gyratory motion of the fluid to be acted on inside the churn, is prevented, it being thrown inwardly towards the said lower shaft, by the first mentioned float, and, by the second, back towards the sides of the churn, and the volume passed between those two constantly divided in the middle, and thrown each way, by the obtuse angle of the float thirdly above mentioned, and every part of the fluid rapidly stirred, and exposed to the action of the air, admitted through the aperture in the lids around the lower shaft, and the process of making butter from cream facilitated and shortened, while none of it is thrown out at the top by the revolving of said floats."

4. For an *Improvement in the Lard Lamp;* B. K. Maltby, of Rootstown, & Jesse Neal, of Middlebury, Ohio, May 4.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the construction and use of a wick tube, closed at the bottom, and perforated with numerous openings through its sides, to admit the lard to the wick, and, at the same time, prevent the wick from being displaced or crowded up from below, in combination with the above described lamp, for forcing up the lard, or any other acting on similar principles."

5. For a *Machine for Cross Napping Cloth;* John Taylor & John Smith, New Lebanon, New York, May 4.

The cloth passes under two rollers, and between these a cylinder, covered with cards, operates, to raise the nap across the cloth.

The claim is limited to the cross napper, in combination with the two rollers for cross napping.

6. For an *Improvement in the Horizontal Percussion, and Reaction Water Wheel;* Saml. Diehl, Manallen, Pennsylvania, May 4.

Without a drawing, we could not give a clear description of the improvements claimed.

7. For an *Improvement in the Cooking Stove;* Anson Atwood, Troy, New York, May 4.

Claim.—"What I claim as new, and desire to secure by letters patent, is the particular manner in which I have arranged and combined the flue spaces, so that the draught from the fire shall first pass around three sides of the posterior part of the oven, and then around three sides of the anterior part, as herein set forth. I also claim the manner of supplying heated air to an oven, by admitting air from the room, through an opening in the rear end of the bottom plate, into the air heating compartment, and thence into the oven, through an opening in the fore end of the bottom plate of the oven; the respective parts being arranged substantially in the manner set forth."

8. For an *Improvement in Cotton Gins;* F. J. James, Princeton, Mississippi, May 7.

There is a small rotary brush that acts on the fibres, to clean them before they reach the usual stripping brush, and, below, there is a stationary brush for the final stripping of the fibres, and a plate, with slats, through which the saws pass, to prevent the action of the currents of air on the fibres as they approach the stripping brush.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the employment of the additional brush, and the stationary brush, in combination with the saws of the saw gin, in the manner described; and also the plate, in combination with the brush and saws, as described, for the purpose of cleaning the cotton of dust and trash, whilst undergoing the process of ginning, whether arranged in the precise manner before described, or in any other mode substantially the same."

9. For an *Improved Pin for Fastening Shawls, Diapers, &c.;* Thos. Woodward, Brooklyn, New York, May 7.

Claim.—"What I claim as new, and desire to secure by letters patent, is the combining of a concavo-convex shield, which is bent or recurved at its ends, with a pin that is secured thereto, by an eye or loop, at one end, and the point of which is to pass into, and be retained by the hollow in the recurved part of the opposite end, in the manner and for the purpose herein fully set forth."

10. For an *Improvement in the Door Latch;* Geo. E. Sellers, Cincinnati, Ohio, May 7.

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner in which I have formed and arranged the weight, and combined it with the other parts, by means of which the bolt is forced out, as set forth: that is to say, a weight, the operation of which is the same in either of the two directions, in which the latch may be affixed to the door."

11. For an *Improvement in the Press for Pressing Cotton;* Samuel Fry, New York, May 7.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the use of the chain and fusee, in connexion with the jointed levers, in the manner above described, or by any combination of those parts essentially the same, by which a continuous motion is given to the platen, with such increase of power as may be required."

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12. For an *Improvement in the Construction of Iron Vessels;* James Kerr, Wm. Grant, & John Potter, Pittsburg, Pennsylvania, May 7.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the lining iron vessels used in navigation, between the ribs, with metal, so as to form water tight chambers all around the sides, in the manner and for the purpose above described."

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13. For an *Improvement in the Sleigh;* T. R. Timby, Auburn, New York, May 7.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is placing the box or body on an axle or balance rod, in combination with one or more springs, arranged under the body, in the above described manner, or in any other substantially the same."

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14. For *Improvements in the Machine for Cutting Shingles;* D. M. Cummings, East Lebanon, New Hampshire, May 7.

Claim.—"What I claim as constituting my invention, and desire to secure by letters patent, is the particular manner in which I have combined and arranged the respective parts of my machine, as above described: that is to say, I claim the combining of the stationary horizontal table, having eight openings or boxes, more or less, with the revolving table, furnished with two knives, so located, as that only one shall be in action at any one time, and on such angles as will enable them to commence and cut the thin end of each shingle, of the above dimension, off, before the cutter begins on the thick end, and with the system of weighted levers, for holding the blocks in their places; the whole being formed and operating substantially as herein set forth."

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15. For an *Improvement in Saw Mills;* Saml. Darling, 2nd, Groton, Vermont, May 7.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, first, the arranging of the respective friction rollers, in the boxes or recesses within which they are contained, in such manner as that they shall, at every descent, be acted on by springs and cushions in the lower part of said recesses, in the manner, and for the purpose set forth. I claim, also, the manner of arranging and combining the vertical timbers, which I have denominated false cheeks, so that they may rock or vibrate to the required extent; and so that they, with the friction rollers, shall be kept up to their bearings, by means of springs and wedges, operating substantially in the manner herein described. I claim, likewise, the manner in which I have combined twelve, or more, friction rollers, with a saw frame and fender posts, through the intermedium of false cheeks, which have a vibrating or rocking motion, and which are borne up against the saw frame by the action of springs; the general arrangement and combination of the respective parts of the whole apparatus being the same, or substantially the same, with that herein fully described and made known."

16. For an *Improvement in the take-up and let-off motions of Power Looms;* B. W. & H. Hendrick, Woonsocket Falls, Rhode Island, May 12.

Claim.—"What we claim herein as new, and desire to secure by letters patent, is the manner in which we have combined the two worm wheels, with the yarn and the cloth beams, one of said wheels having a right handed, and the other a left handed thread, so as to cause them, by their counter action, to preserve the two beams in their required relative positions, without the aid of a friction band, or any analogous device. We claim, likewise, the manner in which we have arranged and combined the worm wheel, the shaft, the spiral spring, the clutch wheels, and the cloth beam, so as to admit of the yielding of the latter, with the varying tension of the warp."

17. For an *Improvement in the Bee Hive;* Frederick Wolfersberger, Plymouth, Ohio, May 12.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the slides with the small drawers, perforated at the top, with holes corresponding to the plug holes; said slides being used in connexion with said drawers and plug holes, for the purpose of smoking and driving the bees from the boxes, to secure honey, without injuring the bees; using for that purpose, any metallic, or other substance, which will produce the intended effect."

18. For an *Improved Mode of Multiplying and Equalizing Swarms of Bees;* James Jones, Galway, New York, May 12.

The patentee says,—"The nature of my invention consists in the construction of a bee hive of two equal and distinct parts, which, when joined together, form one complete, enabling the apiarian to form two hives, of one full and one empty hive, by taking apart the two halves, and adapting to each other a full, and an empty half; thus forming of one swarm, two swarms of bees, which will continue their labors in each, as well as swarms produced by the natural process of swarming; and which may be continued through the swarming season, as often as they are full."

Claim.—"What I claim as my invention and improvement, and desire to secure by letters patent, is the adapting together two halves of a hive, constructed according to the above specification, or in any similar convenient form, so that the same may be taken apart, and adapted to, and connected with, an empty half of a hive, for the purpose of separating one swarm of bees, and their honey or products, into two, to prevent the trouble and risk of their swarming, and the injury or loss of the bees."

19. For a *Machine for Making Bricks;* Antoine Carbonel, Philadelphia, Pennsylvania, May 12.

The claim refers to, and is dependent on, the drawings, and we therefore omit it; but it is limited to the combination of the eccentrics, and pistons with the toggle joints, by means of which the brick is pressed at the same time from opposite sides, and then discharged.

20. For an *Improvement in the Mode of Altering the Set of Iron Ploughs;* Nathan Hull, De Kalb, Mississippi, May 12.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of this braced frame to the use and purpose of altering the mode of setting iron ploughs, to and from land. The remaining portions I hereby disclaim."

21. For a *Door Lock, called the Quadrant Bolt Combined Lock and Latch;* G. E. Sellers, assigned to Miles Greenwood, Cincinnati, Ohio, May 12.

Claim.—"I do not claim to be the first to have substituted a gravitating weight for the springs, usually employed for forcing the latch bolt forward, this being a device well known; but what I do claim, as constituting my invention, is the particular manner in which I have arranged and combined the quadrant bolt, the tumbler, and the turn-buckle or cam, so as, by said arrangement and combination, to cause the quadrant bolt to be acted upon by the key, by the turn-buckle, and the tumbler, substantially as herein set forth and made known."

BIBLIOGRAPHICAL NOTICES.

Hunt's Merchants' Magazine, and Commercial Review. Freeman Hunt, Editor and Proprietor. Published monthly, at 142 Fulton Street, New York.

This well-conducted journal, published in the great commercial emporium of the Union, and specially devoted to subjects connected with Commerce, Manufactures, and Political Economy, must be a welcome monthly visiter to the counting house of the man of business. But not only to the merchant and manufacturer is it valuable and instructive; for such is the varied nature of its contents, and so expansive the scope of its design, that the engineer, the artisan, the agriculturist, the statesman, the political economist, and the general reader, will find in its pages much that relates to the productions, manufactures, resources, improvements, revenue, and general statistics of our country, tending to illustrate the general progress, and specific details of our business operations, and industrial pursuits.

We regard every publication which tends to develop, encourage, and give a proper direction to the productive industry of our country, whether commercial, manufacturing, or agricultural, as a public benefit; and journals of this kind, when conducted with ability and impartiality—not to subserve local or individual interests, but for the purpose of disseminating authentic facts, and reliable information for the common good,—are worthy of substantial encouragement. In our widely spread, and industrious community, though each individual may, in his particular sphere of business, conduct his concerns with commendable diligence, and to his own particular advantage; yet how greatly is enterprise stimulated, industry strengthened, and the common welfare promoted, by the general diffusion of correct information, concerning the various changes, modifications, and improvements which are constantly taking place in our business relations;—and how interesting are statements concerning the operations in particular branches, or the aggregate amount of business, trade, product, or labor, for particular places, or for stated periods.

The matter contained in each number of this Magazine, is arranged under the following appropriate general heads: 1. Original and Selected Articles upon subjects connected with Commerce, Manufactures, Internal Improvements, and other general topics. 2. Mercantile Law Cases. 3. Commercial Chronicle and Review. 4. Mercantile Miscellanies. 5. Commercial Regulations in this and foreign countries. 6. Nautical Intelligence. 7. Railroad, Canal, and Steamboat Statistics. 8. Commercial Statistics. 9. Journal of Mining and Manufactures. 10. Journal of Banking, Currency, and Finance. 11. Notices of New Publications.

Many of the original articles are well written, and display a thorough acquaintance with the subject discussed. We are gratified to observe, in the number for June, an able paper by our fellow-citizen, Col. C. G. Childs, on the Iron Trade of Europe and the United States, with special reference to the Iron Trade of Pennsylvania. Such articles as this, and a number of others, which have appeared in the pages of the Merchants' Magazine, are not only creditable to the ability and research of the writers, but have a direct tendency to promote the best interests of our country, by imparting a just view of the extent and importance of our resources, and a knowledge of the proper means for making them available for our advantage.

The pages of this magazine present a body of statistical information, which is invaluable for purposes of reference and comparison. It is to be regretted, that, among a people so energetic, enterprising, and productive, as those of the United States, more attention has not been given to collecting and preserving *accurate* statistical accounts of our business transactions, and industrial operations, as connected with commerce, arts, manufactures, and agriculture. Our decennial census, if correctly taken, would supply, at rather remote periods, much useful information in this respect; but experience has shown that, as heretofore managed, the returns are, too generally, such, that little reliance can be placed upon their accuracy. Until more care shall be exercised in the taking of this census, or the business confided to more careful and competent agents, than some who have been employed for that purpose, we shall in vain look to this source, for reliable statistical knowledge concerning our country.

In our great commercial cities, where the population is dense, and business concentrated, peculiar facilities exist for obtaining a complete account of the number of inhabitants, buildings, improvements, trade, products of labor, amount of business, valuation, &c., &c. Boston, with her characteristic enterprise, has already taken the lead in this matter, as in some others of a commendable nature. The census of that city, taken under the authority of its Council, in 1845, and published in a volume of nearly 300 pages, embraces a most valuable account of the population, progressive wealth, commerce, manufactures, valuation, finances, public institutions, buildings, &c., with statistics of the different classes of population, their domestic condition, education, health, pauperism, crime, and various other subjects of interest, relating to the history and condition of the community of Boston, and their means of progress and prosperity.

A movement has also been made towards a similar undertaking, in the City Councils of Philadelphia, and this laudable project, we believe, is only delayed, with a view of obtaining the co-operation of the adjoining corporate districts, which, although not included within the *city proper*, yet constitute about two-thirds of what is popularly known as Philadelphia. A complete statistical census of the city and districts, which, in fact, all belong to the same great municipality, is, at this time, very desirable, as a means of properly knowing and estimating the vast manufacturing, artistic, commercial, and other productive resources of Philadelphia; but, to be complete, or, indeed, in any considerable degree satisfactory or useful, it must include both *city* and *districts*. By the adoption of a properly matured plan, and the employment of a few active and competent persons to collect the requisite information, a complete statistical census of Philadelphia might be taken, at an expense so small as to appear trifling, when compared with the benefits which would result from a successful completion of the undertaking. We earnestly hope that this subject will be favorably considered by the corporate authorities of the city and districts, and that, by carrying the design into effect, a fund of valuable knowledge will be acquired, concerning the present condition of Philadelphia, her productive industry, progressive wealth, and elements of future prosperity, which will prove advantageous to her interests, both at home and abroad.

T.

De Bow's Commercial Review of the South and West; a Monthly Journal of Trade, Commerce, Commercial Polity, Agriculture, Manufactures, Internal Improvements, and General Literature. New Orleans. J. B. De Bow, Editor and Proprietor.

The rapidly increasing spirit of enterprise and improvement, now so vigorously manifest in the Southern and Western States, is ably seconded and supported by this valuable Journal, which, itself, bears marks, since its first establishment, in 1846, of great improvement, both in matter and mechanical execution. From its present appearance, we should judge that the enterprising publisher has not been mistaken, in supposing that "the wants of the South demanded such a Journal,"—and that the people of the wide and fertile region, to whose interests it is mainly devoted, are disposed to encourage a publication, calculated to develop the inexhaustible resources, exhibit the statistics, advocate the policy, and promote the prosperity of that important section of the Union.

Among the interesting and instructive articles, which we have particularly noticed in several numbers of this Journal, may be mentioned, several on the Culture and Manufacture of Sugar in Louisiana; on Southern and Western Agriculture; Notes on the Geology of Alabama and the Mississippi Valley; on the Climate and Diseases of the South; on Domestic Manufactures in the South and West; on Cotton and Cotton Planters; Sketches of the Ouachita and Plaquemines regions; on the Progress of American Commerce; on the Mississippi, its Sources, Mouth, and Valley; on Mexico, and the Trade with that country; as well as many others, replete with valuable information. The subjects of American and Foreign Commerce, Agriculture, Statistics of Cities, Internal Improvements, Manufactures, and matters generally, relating to Trade and Commerce, receive a due share of attention.

We regard the Commercial Review as a valuable and important auxiliary to those publications, which have for their object, the promotion of the business interests of our common country; and particularly so, as it is mainly devoted to a region, the growing importance of whose trade and productions, renders information concerning its progress and statistics, more interesting and desirable from year to year. T.

FRANKLIN INSTITUTE.

Use of Anthracite Coal in Locomotives.

At the monthly meeting of the Franklin Institute, held June 17th, 1847, the following remarks on the use of Anthracite in Locomotives, were made by Professor W. R. Johnson.

Since the attainment of so complete a success, in using anthracite under the boilers of stationary engines, and on board of all our principal river and sound steam vessels, on the Atlantic coast, it has become a subject of much inquiry, to determine why so little success has attended the efforts to introduce it into general use upon railroads. Various trials, on the Columbia Road, and others on the Reading Road, have, it is understood, been attended with so little promise of advantage, as to cause, at present, the abandonment of that fuel, and an adherence to wood, as the only available material. The cost of wood, alone, to the Reading Railroad, during the last year, is put down, in the late annual report, at $202,061, and, as the total quantity of coal brought to market, over the road, was 1,188,258 gross tons, we have, after deducting the wood required for passenger and freight trains, an expense of $191,569, for the wood required to haul that quantity of coal 94 miles, and to take back the empty cars. It is true, that the whole of this coal did not reach tide-water, but the computation is based upon the fact, stated in the report of the Company, that the cost of wood, "per round trip of 188 miles," to haul 360 tons of coal, the above distance, and "back with empty cars," was 14·92 cords, costing $58·04. It is estimated, by the President of the Railroad Company, that the introduction of anthracite, instead of wood, would save the company $125,000 per annum. Should it save half this sum, it is evident that great outlays, to effect the purpose, would be warranted, and, consequently, the efforts heretofore made would be fully justified. Mr. Nichols, the engineer, and general superintendent of the Reading Road, has been, for some time, engaged in an effort to accomplish this object, by placing the engine and boiler on separate carriages, with a view to an enlargement of the fire surface of the latter. Mr. N. has, in fact, used an ordinary locomotive, to which he has attached, on a separate truck, a boiler, 16 feet long, and 4½ feet wide, with a semi-cylindrical arch running the whole length. This is connected, by jointed pipes, with the engine. The blast is created by a fan, driven by a small engine. The escape steam is thrown into what was the original boiler of the locomotive engine, which is still retained, for the double purpose of serving as a *condenser*, and of making weight on the driving wheels. If this plan of condensation shall be found available, much time will be saved which is now consumed at water stations, as a large portion of the water will be constantly circulating.

So important to the Reading Railroad, has this item of expenditure of *fuel* become, that, during the past year, efforts have been made by the company to manufacture an artificial fuel, with a basis of anthracite, as a substitute for wood. In this, they are understood to have so far succeeded, as to have made some trips with it. But still the desideratum is the use of anthracite alone.

Having several times, within seven or eight years, witnessed the exclusive use of anthracite, in all the locomotives on the Beaver Meadow, and Hazleton Railroads, making round trips of thirty or forty miles, I have felt much interest in tracing the causes of ill success elsewhere.

From all the inquiries which I have been able to make, the following appear to be regarded as the chief impediments to the use of anthracite in locomotives.

1. The want of rapid ignition, and free, lively combustion.

2. The intense, concentrated, local heat, which is said to destroy the grate bars, to attack the rivets and laps of the fire box, and even to cause blisters to rise in the plates of which it is composed; and, finally, to fuse the ashes into a troublesome clinker.

3. The sharp, angular particles of coal, projected by the violent, fitful blast of the escape-steam, obliquely into the ends of *copper* tubes, cuts them away within a few inches of the fire end. In the upper range of tubes, it is the upper side which is chiefly attacked, and, as might be anticipated, in the lower ranges, the lower sides are most worn away. The effect of this cutting is usually limited to four or six inches of the length of the tubes.

4. The difficulty of fitting in iron tubes, so as to make perfect joints, and, at the same time, avoid irregularity in the form of the heads, and loosening one tube while another is fastened.

As the first of the above difficulties, the want of proper activity in the fire, has been completely overcome in our steamboats, by the use of a steady fan blast, it seems that an equivalent blast in the locomotive ought to produce the same effect. The irregular, fitful current, generated by the waste steam, is not in all respects an equivalent to the blast of a fan, but when that blast is equalized, by projecting the escape steam, first into a receptacle of considerable magnitude, and then through a number of small pipes, equally distributed over the area of the chimney, the blast is so nearly equable, as to answer completely the purpose of sustaining the fire in brisk and uniform activity. This method of disposing of the escaping steam, originally invented by Mr. Gurney, and applied in common road engines, to prevent the frightening of horses, by the sudden, violent belching sound, was first introduced here by Mr. Hopkins Thomas, now of Beaver Meadow, while a workman in the employ of Messrs. Eastwick & Harrison. His object was a steady blast, not the mere avoidance of disagreeable noise.

The steam box used to equalize the draught, is cylindrical, 12 inches in diameter, and 11 inches deep; two tubes, each three inches in diameter, flanched at the opposite ends to the steam chests of the two cylinders of the locomotive, support the box in the interior of the dust chamber, and convey the escape steam to its centre. A lid, ground to fit the top of the steam box, has 18 jet pipes, rising two or three inches from its upper surface, drawn in at the top to a diameter of half an inch. These are placed just beneath the base of the chimney, and their purpose is to distribute the escaping steam throughout the chimney, and, by limiting, to some extent, the rapidity of flow, to maintain within the box a pressure *approaching* to uniformity.

Messrs. Eastwick & Harrison founded, on a division of the receptacle into two parts, a patent, which they applied in some engines built by themselves. But as this evidently tended to make the action of the steam upon the air of the chimney, in a degree partial and fitful again, the Beaver Meadow and Hazleton Companies discarded this modification of Gurney's plan, and in all their engines, which have constantly used anthracite for the last eight or nine years, the draught is ample, the combustion regular, and the evaporation vigorous and well sustained. The fire is, of course, *kindled* with wood, and when this is well ignited, anthracite is added by little at a time, usually not more than a single shovel full, and in lumps, commonly not above six inches in diameter. If larger than this, they would remain too long in mass, dark and ineffectual; if small egg or nut coal alone were used, it would, it is alleged, by the jarring of the locomotive, spread over the whole fire at once, and check the evaporation. While under way, the bed of coal upon the grate is kept at a thickness of five, or at most, six inches. When fresh coal is added, care is taken, that a single shovel full only is put on at once, and that this is thrown on the part which appears thinnest. Much experience in watching the indications of a manometre, while generating steam by anthracite, enables me fully to appreciate the importance of these practical precautions. In some of the attempts to use anthracite on the Reading Railroad, a bed of 18 inches thick is said to have been allowed to accumulate on the grate. In such cases, the whole engine is said to have become excessively overheated, and a flame to have passed out at the chimney. This is easily understood, when we consider that, in passing through so thick a mass of hot coal, the carbonic acid at first formed, (CO_2) by taking up a second proportional of carbon, becomes $CO + CO$, or two proportionals of carbonic oxide. The atmospheric air to ignite this compound, gains admittance partly through the chinks of the fire door, and the dust box door, and is partly found near the chimney top, where the intermitting blast through a single jet pipe, keeps the chimney alternately receiving and emitting air.

The second evil, that resulting from the highly concentrated heat, has been found much more serious than the preceding. Grate bars were burned out in a few weeks. Capt. A. H. Vancleve, who had charge of the Beaver Meadow Road, states that, at one period, wrought iron bars were substituted for cast, but that it required two smiths' fires to be in constant employ, to make grate bars for four locomotive engines. The secret of preventing this occurrence, was stated by a gentleman at Hazleton, to have been discovered by accident. A boulder, which had rolled from a slope upon the track of the railroad, tore off the ash box of the first engine which passed. As the damage did not interfere with the running of the engine, and as it was not convenient, for some days, to return to the machine shop, it was permitted to continue its trips for some days, without an ash box. The overheating and wasting of grate bars were so manifestly obviated during the time, as to attract immediate attention. Ash boxes were successively removed from other engines, and, from the adoption of this alteration to the present time, the destruction of grate bars has ceased to be a source of serious inconvenience. A set in the locomotive Franklin, were put in in June, 1846, and were in use, and in good order, at the end of May, 1847.

It might be supposed that the wooden superstructure of the road, and particularly that of bridges, would be endangered by the constant falling of sparks. In the main, it may be said, that this evil at length cures itself, for both road and bridges, except the rails, become covered with a stratum of cinder, and fine particles of coal, which effectually defends all beneath from danger of igniting by particles of hot matter from the grate. Unlike particles of ignited charcoal, these are, from their very weight, not liable to be easily raised and blown about, by the currents of air created by the cars, which pass over them after they reach the road. Hence the only precaution which has been found necessary, is to place two sheets of iron, one on each *side* of the bottom of the fire box, extending downwards about nine inches, and sloping inwards, to confine the falling cinders to the central part of the track. At first a watch was established at the bridges, but when the roadway became covered with cinder, there was found to be very little danger from this source. The Hazleton and Beaver Meadow Roads have wooden rails, laid with flat iron bars; where edge or T rails are used, the danger would be manifestly less than in the case of these roads, which have so long used anthracite without detriment.

The concentrated heat of anthracite fires, generally affects injuriously only the laps and rivets of the fire box, unless the iron of that part of the boiler be of inferior quality. Hence the importance of selecting the very best of iron for the fire box, and the probable utility, as suggested by Capt. Vancleve, of subjecting it to a high temperature before using any plate for this purpose, in order to detect blisters or imperfect weldings, if such exist in the interior. The number of pieces used in the lower part of a fire box, ought to be the least possible, and the horizontal laps ought not to have their edges presented downwards to the action of the rising flame. I see no practical difficulty in the way of rolling sheets 18 inches wide, long enough to form the entire circuit of the lower part of a fire box. Above that height there would be no danger from this peculiar action of the fire. Nor do I know of any serious objection to welding together the ends of such a sheet, especially if made three-eighths of an inch, or more, in thickness, and thus forming a band in which not a single joint or rivet should come in contact with the fire. All other parts of the boiler would still be made in the ordinary manner.

The locomotive Lehigh commenced running on the Hazleton Road in 1838. In 1844 it was found necessary to renew a space of about 18 inches, in the lower part of the fire box, and this is the only repair which that part has undergone since the engine was put upon the road. I examined it in the latter part of May, 1847, and found the iron, to all appearance, sound and good, with no leaks at the rivets, or elsewhere. Three or four of the upper rows of tubes in this engine, have been in use since 1839, and the rest were renewed about two years ago.

To avoid the conversion of ashes into clinker, those anthracites should be selected, which are free from slaty plies, and which contain the least of sulphuret of iron, or other fusible impurities. Should any inconvenience be found from clinker on a prolonged trip, it could easily be removed at a watering station, by means of a forked fire hook, adapted to that peculiar service. A small supply of wood may be carried, for re-kindling, in case of unusual delays. But the experienced fireman will always be careful to clear coal and clinker from his grate, before he attempts a renewal with wood.* Grates may be hinged, with a view to the prompt discharge of their contents, and, with that facility, the re-kindling with wood may take place even without stopping the engine, especially if advantage be taken of a favorable grade of the road.

The third point of difficulty, that resulting from the cutting away of copper tubes, is fully obviated by the substitution of iron, with the farther advantage of economy in the first cost. But this brings us to the fourth and last difficulty—that of securing iron tubes to the heads of the boiler.

This has been attempted in several different ways. One consists in cutting a screw at each end of the tube, to enter corresponding threads cut in the heads of the boiler, and then riveting over the projecting edges of the tubes. That on which Mr. Baldwin has founded a patent, consists in brazing a short piece of copper tube to each end of the iron one, and then connecting the former with the head of the boiler, in the same manner as he puts in copper tubes. But that which seems the most simple, and which is quite effectual, as proved at Beaver Meadow and Hazleton, for a course of years, is the turning off of the iron tubes, on the outside, at each end, in the form of the frustrum of a cone, to the distance of seven-tenths of an inch, by which the thickness of the tube at the extremity is reduced about one-half. This conical part receives a ring of copper, cylindrical within, conical without, and about half an inch wide, which, after the iron tube has been inserted in its place, is driven on to its conical termination, filling the space between it and the edge of the aperture in the head of the boiler. This copper ring, by its wedging effect, tightens the iron tube, forms a close joint, and allows the edge of the iron tube to be slightly opened out, and riveted, to form a very perfect juncture. The language used in describing the result of this mode of fitting in the tubes, was, that the "joints never leaked a drop." In rare instances, the welding of a tube, (made by the same process as gas tubes,) is found slightly defective, but this does not long put a stop to the use of the engine, for a very little labor suffices to tap a screw in each end, and plug up a single defective tube, till a convenient opportunity occurs for its removal. To clear dust of anthracite from the tubes, a species of screw auger, with a sharp edge, like that of a chisel, is occasionally employed.

The quantity of anthracite commonly used in a round trip of 30 miles, on the Hazleton Road, is from a ton to a ton and a half, hauling 35 to 40 cars, and conveying from 100 to 120 tons of coal. The grades on this road are heavy,—60, 80, and 140 feet per mile,—all in the direction of the trade. The severest labor is, consequently, encountered, in taking back the empty trains. In two experiments, conducted by Capt. Vancleve, over the Beaver Meadow Road, reducing its grades by Pambour's formula, to the condition of a level, he found that the seven ton engine required 1½ pounds of anthracite per ton, per mile, of *freight and cars* hauled, and the 13 ton engine took but one pound, for the same labor. The small engine was subject to slipping of its wheels, on the high grades, which, of course, impaired the efficiency of its fuel.

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*This, and the succeeding precaution, are suggested by Capt. Vancleve.

Those who are most familiar with this subject, attribute to the early, persevering, and well directed efforts of the Hon. Samuel D. Ingham, formerly President of the Beaver Meadow Railroad Company, much of the credit of urging on to final success, the experiments which have proved so important to the interests of that coal region.

MECHANICS, PHYSICS, AND CHEMISTRY.

On the Gauges at present used, for measuring the thickness of sheet metals and wires, and proposals for a new system of Gauges, founded on the decimal subdivision of the Standard Inch. By C. Holtzapffel.

From the Glasgow Practical Mechanic and Engineers' Magazine.

In setting out the Tables of the dimensions of saws, the author could only express their several thicknesses, in the measure always employed for that purpose, namely, in the sizes or numbers of the "Birmingham wire gauge," and to render these measures intelligible to the general reader, the author then determined to introduce in this appendix—first, the exact values of the principal gauges in use for sheet metals and wires, a subject he believes to have been hitherto overlooked; and secondly, a proposal he has long desired to see carried out, namely, an easy and exact system of gauges for sheet metals, wires, and general purposes, founded on the decimal division of the inch; and in which system, the nomenclature should be so completely associated with the actual measures, as to convey to the mind, even in the absence of the gauges themselves, a very close idea of the several spaces of the gauge, or of the thicknesses or sizes of the works measured thereby.

It is to be observed, at the outset, that the gauges for measuring wires and sheet metals, are usually thick plates of steel of several sizes and forms, around and near the edges of which are first drilled various holes, the next step is to saw a notch from the edge into every hole, saws of the widths of the several notches being used; and lastly, little parallel plates of steel, called *drifts*, which are hardened and tempered, are driven into the notches, in order to smooth the sides of the same and render them of uniform width, after the manner of various other applications of drifts.

It should be further observed that the Birmingham and other guages seem to have been originated, in a great measure, accidentally, or almost by the eye alone, and without any attempt at system, either as regards the values of the intervals between the successive measures or numbers, or their correspondence with the subdivisons of the inch. And as moreover gauges, nominally the same, have been made by various manufacturers with insufficient aim at unity of measures, some irregularity thence exists amongst the gauges in common use, notwithstanding that they may be nominally alike.

Values of Gauges for Wire and Sheet Metals in General Use. Expressed in Decimal Parts of the Inch.

SECTION ONE.		SECTION TWO.		SECTION THREE.					
Birmingham Gauge for Iron Wire, and for Sheet Iron and Steel.		Birmingham Gauge for Sheet Metals, Brass, Gold, Silver, &c.		Lancashire Gauge for Round Steel Wire, and also for Pinion Wire. The smaller sizes distinguished by Numbers. The larger by Letters, and called the Letter Gauge.					
MARK.	SIZE.	MARK.	SIZE.	MARK.	SIZE.	MARK.	SIZE.	MARK.	SIZE.
0000	·454	1	·004	80	·013	40	·096	A	·234
000	·425	2	·005	79	·014	39	·098	B	·238
00	·380	3	·008	78	·015	38	·100	C	·242
0	·340	4	·010	77	·016	37	·102	D	·246
1	·300	5	·012	76	·018	36	·105	E	·250
2	·284	6	·013	75	·019	35	·107	F	·257
3	·259	7	·015	74	·022	34	·109	G	·261
4	·238	8	·016	73	·023	33	·111	H	·266
5	·220	9	·019	72	·024	32	·115	I	·272
6	·203	10	·024	71	·026	31	·118	J	·277
7	·180	11	·029	70	·027	30	·125	K	·281
8	·165	12	·034	69	·029	29	·134	L	·290
9	·148	13	·036	68	·030	28	·138	M	·295
10	·134	14	·041	67	·031	27	·141	N	·302
11	·120	15	·047	66	·032	26	·143	O	·316
12	·109	16	·051	65	·033	25	·146	P	·323
13	·095	17	·057	64	·034	24	·148	Q	·332
14	·083	18	·061	63	·035	23	·150	R	·339
15	·072	19	·064	62	·036	22	·152	S	·348
16	·065	20	·067	61	·038	21	·157	T	·358
17	·058	21	·072	60	·039	20	·160	U	·368
18	·049	22	·074	59	·040	19	·164	V	·377
19	·042	23	·077	58	·041	18	·167	W	·386
20	·035	24	·082	57	·042	17	·169	X	·397
21	·032	25	·095	56	·044	16	·174	Y	·404
22	·028	26	·103	55	·050	15	·175	Z	·413
23	·025	27	·113	54	·055	14	·177	A 1	·420
24	·022	28	·120	53	·058	13	·180	B 1	·431
25	·020	29	·124	52	·060	12	·185	C 1	·443
26	·018	30	·126	51	·064	11	·189	D 1	·452
27	·016	31	·133	50	·067	10	·190	E 1	·462
28	·014	32	·143	49	·070	9	·191	F 1	·475
29	·013	33	·145	48	·073	8	·192	G 1	·484
30	·012	34	·148	47	·076	7	·195	H 1	·494
31	·010	35	·158	46	·078	6	·198		
32	·009	36	·167	45	·080	5	·201		
33	·008			44	·084	4	·204		
34	·007			43	·086	3	·209		
35	·005			42	·091	2	·219		
36	·004			41	·095	1	·227		

In ascertaining the precise measures of the principal gauges, the author has had the valuable co-operation of the Messrs. Stubs, of Warrington, who manufacture a large number of these gauges, and who tested the drifts they employ, by means of a sliding gauge, constructed by Holtzapffel & Co., for reading off quantities to the thousandth part of an inch, by means of a vernier; the results of these admeasurements are stated in the three sections of the accompanying table.

The three series of measures or gauges particularized in the annexed table, have no relation whatever to one another; for example, the numbers 10 of the table are respectively different and undefined quantities, or are neither aliquot nor direct fractional parts of the inch, as the number 10 notches are severally ·134, ·024, and ·190 of an inch wide; and other similar numbers are also unrelated.

The approximate measures of any one of these three series may, perhaps, be moderately familiar to those artizans who use that particular gauge, but these same artizans will probably be as little informed of the two other gauges, as the generality of individuals, to whom the whole of these, and other arbitrary ill-defined measures are vague and confused; because their nomenclatures have no relation whatever, either to one another, or to our general standard of such quantities, namely, ordinary linear measure; or in other words, the standard foot and inch.

The following explanatory remarks on the three gauges specified in the table, and certain other gauges derived from them, will show the complicated and uncertain nature of the subject of measures for wires, sheet metals, and various small works.

1. The first column of the Table refers to the gauge used for most kinds of wire, and is thence called for the sake of brevity, the "Wire gauge," although it is also known as the "Birmingham wire gauge," the "Birmingham iron wire gauge," and the "Sheet iron gauge." This gauge, which is specified in the column of the Table headed Section one, is the most common of the three principal kinds, and is employed not only for iron wire, as its name implies, but also for brass and other wires, for black steel wire, also for sheet iron, sheet steel, and various other materials, and likewise for some manufactured works, including screws for joiners' use.

On reference to the Table, it appears the largest notch of the Birmingham iron wire gauge, is marked 0000, and measures 454 thousandths of an inch, or 4½ tenths of an inch nearly; and further, that the smallest notch, marked 36, measures 4 thousandths, or the 1-250th part of an inch. Although this gauge seems only to possess 40 terms, in reality not less than 60 sizes of wire are made, as intermediate sizes are in many cases added; and occasionally, although the sizes are retained, their numbers are variously altered: thus,

The sizes of wires drawn for manufacturing needles correspond with some of the ordinary wire sizes, but the numbers are different; thus No. 1. of the needle wire, agrees with 18½ of the Birmingham wire guage as here shown:—

Needle wires, Nos. 1. 2. 2½. 3. 4. 5. and thence to 21.

And Birmingham wire guage, Nos. 18½. 19. 19½. 20. 21. 22. and thence to 38., are respectively alike.

Sometimes half sizes of both series are interpolated, and the manufactured needles, when bought and sold, are designated by another series of numbers, unrelated to either of these wire sizes.

Numbers of the Screws.	Numbers of the Wire Gauge.	Numbers of the Screws.	Numbers of the Wire Gauge.	Numbers of the Screws.	Numbers of the Wire Gauge.	Numbers of the Screws.	Numbers of the Wire Gauge.
25	0000	14	3	7	9	1	15
23	000	12	4	6	10	0	16
22	00	11	5	5	11	00	17
21	0	10	6	4	12	000	18
17	1	9	7	3	13		
16	2	8	8	2	14		

In the wire used for the strings of piano-fortes, the sizes now commonly used, are known as Nos. 6 to 20, and these agree very nearly with the sizes and half-sizes of some of the notches of the Birmingham wire gauges, as follows:—

Music wires, Nos. 6. 7. 8. 9. 10. 11. 12. 14. 16. 18. 20.

And Birmingham wire gauge, Nos. 26. 25½. 25. 24½. 24. 23½. 23. 22. 21. 20. 19., are respectively alike.

The number 6, or the thinnest music wire now commonly used, measures about the fifty-fifth part of an inch in diameter, and the No. 20, or the thickest, measures about the twenty-fifth of an inch.

Piano-fortes were formerly always strung with brass wire, but steel is now alone employed, and they are "strung much heavier," or thicker wires are employed, from which cause the numbers 1 to 5 have probably fallen into disuse. The covered strings are of steel, upon which a fine copper wire is spirally wound; and in very short strings, as those in Mr. Pape's Console Piano-fortes, and some others, two covering wires are used, that the bulk of the doubly-covered strings may compensate for their want of length.

The manufacturers of the patent screws made from iron wire, for joiners' use, also give the intervals of the wire gauge a new system of numbers. Thus in the annexed Table, the left hand columns show the numbers of the screws, the right hand, the numbers of the wires from which they are respectively made.

Examples of other and similar conversions of the numbers might be shown, but which would only serve further to illustrate the irregularity, and arbitrary nature of gauges, used in the mechanical and other arts.

2. The second column of the Table, refers to the gauge employed for most of the sheet metals, (excepting iron and steel,) namely, copper, brass, gilding-metal, gold, silver, platinum, &c. This gauge is called the "Birmingham metal gauge," and for brevity, simply the "Metal gauge," or the "Plate gauge," in contradistinction to the "Wire gauge," specified in the first column of the Table.

The intervals in the metal or plate gauge, are closer or smaller than those of the wire gauge. Thus the No. 1, which in this series is the *smallest* sized notch, is 4 thousandths or the 250th part of an inch wide, whilst the largest notch, or 36, measures 167 thousandths, or is evidently meant for the sixth part of an inch.

When thicker metals are wanted, their measures are sought in the Birmingham wire gauge; thus the 36 on the plate gauge, nearly agrees with the 8 on the wire gauge, and therefore the numbers 7, 6, 5, to 0000 of the latter, are then employed for thicker metals than can be measured by the plate gauge. Frequently the plate gauge ends at 24, which number agrees with 14 of the wire gauge, and then the numbers 13, 12, 11, to 000 of the latter are similarly resorted to for thicker metals. These combinations of different series of numbers, running in reverse orders, are evidently liable to lead to confusion.

The method in which sheet metals are commercially described, also present much variation, for instance zinc has a gauge thus constituted—

Sheet zinc	Nos. 6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.
B. Plate gauge	Nos. 4.	4½.	5.	6.	7.	8.	9.	10.	11.	12.	13.

are nearly alike.

These thin sheets of zinc, which measure only from one to four hundredths of an inch thick, are principally used for gutters, roofs, and small works manufactured with the hammer.

Thicker zinc plates, or those from about 5 to 18 hundredths thick, and which are used for zincography, door plates, and engraved works, are commonly made to the notches, 18 to 7 of the Birmingham wire gauge, without alteration of the numbers, but which run the reverse way of those of the other series used for zinc.

Several of the metals are estimated by the weight of every superficial foot, and that the more especially when the value of the material, in the sheet, exceeds the value of the labor afterwards expended upon it in converting the metal to its intended purpose; thus:—

Cast and milled lead are both described as of from 4 to 12 pounds to the superficial foot, the variation being one pound to the foot.

Coppersmiths and braziers do not acknowledge the plate gauge at all, but reckon their metal as from about 3 to 56 pounds to the sheet; the sheet measures 2 feet by 4 feet, and therefore contains 8 superficial feet.

The precious metals are sometimes estimated as of so many ounces or pennyweights troy to the superficial foot; and it will be hereafter shown, how by the aid of the proposed scheme, derived from the decimal subdivision of the inch, the correspondence between the relative weights and thicknesses of metals, may be critically arrived at with great simplicity.

The third, fourth, and fifth columns of the Table constitute one series of gauges, employed exclusively for the bright steel wire prepared in Lancashire, and the steel pinion wire for watch and clockmakers.

The smallest notch of this series is called No. 80, and measures 13 thousandths of an inch, or about the 120th of an inch; and the first part of this series continues unto No. 1, which measures 227 thousandths, or nearly one quarter of an inch.

The steel wire gauge apparently ended at this size in the first instance, but has since been extended by a second series to the diameter of 494 thousandths, a measure doubtless intended for half an inch. In order to avoid the confusion attendant upon two series of numerals, meeting at zero in the midst, the larger sizes are distinguished by the letters A to Z, and these terms are then continued under the denominations A 1, B 1, C 1, D 1, to H 1, which latter size is the largest, and measures 494 thousandths of an inch, as shown by the Table. This second part of the Lancashire wire gauge, is called, by way of distinction, the "Letter gauge."

Many other gauges of arbitrary characters came to the author's knowledge in this inquiry, several of which are applicable, alone, to particular trades; amongst these may be mentioned, the rod iron gauge, the nail rod gauge, the buttonmaker's gauge, others used in watchwork, and the gauge used by gunmakers for the bores of guns and rifles; three of which gauges alone will be described.

The rod iron gauge, employed by Messrs. Bradleys, and some other iron masters, and also by Messrs. Stubs, for steel, has measures derived from the division of the inch into 8ths and 64ths, as follows:—

Messrs. John Bradley & Co.'s Rod Iron Gauge.

No.	Inch.	No.	Inch.	No.	Inch.	No.	Inch.
00	$\frac{1}{8}$	5	$\frac{5}{16}$	11	$\frac{1}{2}$	17	$1\frac{1}{8}$
0	$\frac{5}{32}$	6	$\frac{11}{32}$	12	$\frac{9}{16}$	18	$1\frac{1}{4}$
1	$\frac{3}{16}$	7	$\frac{3}{8}$	13	$\frac{5}{8}$	19	$1\frac{3}{8}$
2	$\frac{7}{32}$	8	$\frac{13}{32}$	14	$\frac{3}{4}$	20	$1\frac{1}{2}$
3	$\frac{1}{4}$	9	$\frac{7}{16}$	15	$\frac{7}{8}$		
4	$\frac{9}{32}$	10	$\frac{15}{32}$	16	1		

Messrs. John Bradley & Co.'s Nail Rod Gauge.

No.	Inch.	No.	Inch.	No.	Inch.	No.	Inch.
00	$\frac{1}{8}$	1½	$\frac{13}{64}$	4	$\frac{9}{32}$	7	$\frac{3}{8}$
00½	$\frac{9}{64}$	2	$\frac{7}{32}$	4½	$\frac{19}{64}$	8	$\frac{13}{32}$
0	$\frac{5}{32}$	2½	$\frac{15}{64}$	5	$\frac{5}{16}$	9	$\frac{7}{16}$
0½	$\frac{11}{64}$	3	$\frac{1}{4}$	5½	$\frac{21}{64}$	10	$\frac{15}{32}$
1	$\frac{3}{16}$	3½	$\frac{17}{64}$	6	$\frac{11}{32}$	11	$\frac{1}{2}$

It will be perceived that the intervals, from 00½ to 3½ are the 64th of an inch, from 4 to 11 the 32nd, and above 13, the differences are ⅛ of an inch. This mode, although systematic, is objectionable, as there is no evident relation between the numbers and their corresponding measures, and therefore both have to be impressed upon the mind.

In guns of most kinds, the weight of the balls determine the denominations of their respective sizes. Thus it is well known that heavy guns or ordnance are named 6, 9, 12, to 68 pounders, from having bores respectively suited to iron shots of those respective weights, the bore is always $\frac{1}{30}$th larger in diameter than the shot, the difference being known as *windage.* The sizes of the bores of mortars and modern guns intended for hollow shot, are designated in inches, as 8, 10, 12 inch mortars, &c.

In rifles and fowling pieces, the diameters of the bores, designated as No. 1, 2, 3, 4, 5, &c., are the diameters respectively of leaden bullets or spheres, of which 1, 2, 3, 4, 5, &c., weigh exactly one pound avoirdupois; and as the subject may have an interest for some of the readers of this volume, the following particulars of the weights of the balls in grains, and of the diameters both of the balls and of the barrels in hundredths of an inch, are transcribed from Mr. Wilkinson's gauge which he has constructed with great care:—

Mr. Wilkinson's Gauge for Rifles and Fowling Pieces.

Number.	Diameter of bore in hundredths.	Weight of Leaden Bullet in Grains.	Number.	Diameter of bore in hundredths.	Weight of Leaden Bullet in Grains.	Number.	Diameter of bore in hundredths.	Weight of Leaden Bullet in Grains.
5	·98	1400	15	·70+	$466\frac{2}{3}$	25	·60+	280
6	·93—	$1666\frac{2}{3}$	16	·69—	$437\frac{1}{2}$	26	·59+	$269\frac{3}{13}$
7	·89	1000	C 17 P	·67+	$411\frac{13}{17}$	27	·59	$269\frac{7}{27}$
8	·85—	875	18	·66	$388\frac{8}{9}$	28	·58+	250
9	·81—	$777\frac{7}{9}$	19	·65+	$368\frac{8}{19}$	29	·58—	$241\frac{11}{29}$
10	·79	700	20	·63+	355	30	·57	$233\frac{1}{3}$
M 11 P	·77—	$636\frac{4}{11}$	21	·63	$333\frac{1}{3}$	31	·56+	$225\frac{25}{31}$
12	·75+	$583\frac{1}{3}$	22	·62+	$318\frac{2}{11}$	32	·56—	$218\frac{3}{4}$
13	·74—	$538\frac{6}{13}$	23	·61+	$304\frac{8}{28}$			
14 S	·72—	500	24	·61	$291\frac{2}{3}$			

From the perusal of the foregoing particulars of numerous gauges, employed in different branches of mechanical art, it will have been seen that little analogy on the one hand, but great confusion on the other, exist in such of the gauges as have been referred to; and the author will now briefly state the remedy he would suggest to obviate the difficulty in the most simple and inexpensive manner.

(To be continued.)

On the Production of Light by Heat. *By* JOHN WILLIAM DRAPER, M. D., *Professor of Chemistry in the University of New York.*

From the London, Edinburgh, and Dublin Philosophical Magazine.

Although the phenomenon of the production of light by all solid bodies, when their temperature is raised to a certain degree, is one of the most familiar in chemistry, no person, so far as I know, has hitherto attempted a critical investigation of it. The difficulties environing the inquiry are so great, that even among the most eminent philosophers a diversity of opinion has prevailed, respecting some of the leading facts. Thus Sir Isaac Newton fixed the temperature at which bodies become self-luminous at 635°, Sir Humphry Davy at 812°, Mr. Wedgwood at 947°, and Mr. Daniell at 980°. As respects the nature of the light emitted there are similar contradictions. In some philosophical works of considerable repute, it is stated that when a solid begins to shine it first emits red and then white rays; in others it is asserted that a mixture of blue and red light is the first that appears.

I have succeeded in escaping or overcoming many of the difficulties of this problem, and have arrived at satisfactory solutions of the main points; and as the experiments now to be described lead to some striking and perhaps unexpected analogies between light and heat, they commend themselves to our attention as having a bearing on the question of the identity of those imponderable principles. It is known that heretofore I have been led to believe in the existence of cardinal distinctions, not only between these but also other imponderable agents; and I may therefore state, that when this investigation was first undertaken, it was in the expectation that it would lead to results very different from those which have actually arisen.

The following are the points on which I propose to treat:—

1. To determine the point of incandescence of platinum, and to prove that different bodies become red-hot at the same temperature.

2. To determine the color of the rays emitted by self-luminous bodies at different temperatures. This is done by the only reliable method—analysis by the prism.

From these experiments it will appear, that as the temperature rises the light increases in refrangibility; and, making a due allowance for the physiological imperfection of the eye, the true order of the colors is red, orange, yellow, green, blue, indigo, violet.

3. To determine the relation between the brilliancy of the light emitted by a shining body and its temperature.

Here we shall find that the intensity of the light increases far more rapidly than the temperature. For example, platinum at 2600° emits almost forty times as much light as it does at 1900°.

As I prefer to give a complete description of the apparatus employed in these investigations, after the general results are stated, it is sufficient here to understand that the source of light is in all instances a very thin strip of platinum, 1·35 inch long and $\frac{1}{20}$th of an inch wide, brought to the temperature under investigation by a voltaic current. Platinum was selected from its indisposition to oxidize, and its power of resisting a high temperature without fusion.

The slip of platinum, thus to be brought to different temperatures by an electric current of the proper force, was fastened at one end to an inflexible support, and at the other was connected with a delicate lever-index, which enabled me to determine its expansion, and thereby its temperature. For this purpose I have used the coefficient of dilatation of Dulong and Petit. The temperatures here given are upon the hypothesis of the invariability of that coefficient at all thermometric degrees; they are therefore to some extent in error.

By the aid of resisting wires of different lengths and a rheostat, I was able to vary the force of the electric current in the platinum, and thereby vary its temperature. My first attempts were to discover the point at which the metal begins to emit light.

The platinum and the voltaic battery were placed in a dark room, the temperature of which was 60°; and after I had remained there a sufficient length of time to enable my eyes to become sensible to feeble impressions of light, I caused the current to pass, gradually increasing its force, until the platinum was visible. In several repetitions of this experiment it was uniformly found that the index to which the platinum was attached stood at the eighth division when this took place. The metal had therefore dilated $\frac{1}{222}$ of its length; the elevation of its temperature was about 917°, which added to the existing height of the thermometer, 60°, gives for the temperature of incandescence 977° F.

To the correctness of the number it may be objected, that owing to narrowness of the metallic strip it is not well calculated to make an impression on the eye when the light it emits is so feeble; nor can we take the dilatations given by the index, as representing the uniform temperature of the whole platinum, which must necessarily be colder near its points of support, by reason of the conducting power of the metals to which it is attached.

Physiological considerations would also lead us to suspect that the self-luminous temperature must vary with different eyes. The experiments of Bouguer, hereafter to be referred to, indisputably show that some persons are much more sensitive to the impressions of light than others. So far as my limited investigation of this matter has gone, I have not, however, found appreciable differences in the estimate of the temperature of incandescence. Different individuals, observing the platinum, have uniformly perceived it at the same time.

Against the number 977° it may also be objected, that antimony melts at a much lower temperature, and yet emits light before it fuses. If this statement were true, it would lead us to believe that all bodies have not the same point of incandescence. But I think the experiments of Mr. Wedgwood on gold and earthenware are decisive of that question; and, moreover, I have reason to believe that the melting-point of antimony is much higher than is commonly supposed.

With a view of determining directly whether different bodies vary in their point of incandescence, I took a clean gun-barrel, and having closed the touch-hole, exposed the following substances in it to the action of the fire:—platinum, chalk, marble, fluor spar, brass, antimony, gas-carbon, lead; each specimen was small; the platinum was in the form of a coil of stout wire.

When one of these bodies was placed in the gun-barrel and the temperature raised, it is clear that any difference in their point of incandescence would be detected by the eye. Thus, if the ignition of platinum required a higher degree than iron, on looking down the barrel the coil of wire should be dark, when the barrel itself begins to shine; or, if the platinum was incandescent first, the wire should be seen before the barrel is visibly hot; and these results might be corroborated by observing the inverse phenomena, when the barrel is taken from the fire and suffered to cool.

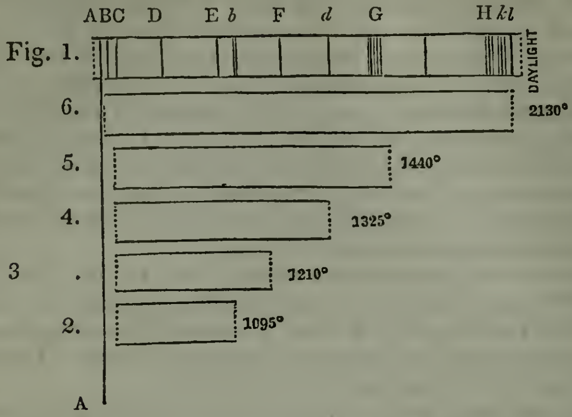
With respect to platinum, brass, antimony, gas-carbon and lead, they all became incandescent at the same time as the iron barrel itself. I could not discover the slightest difference between them, either in heating or cooling; and it is worthy of remark, that the lead was of course in the liquid condition. But the chalk and marble were visible before the barrel was red-hot, emitting a faint white light; and the fluor spar still more strikingly so, its light being of a beautiful blue; and even when the barrel had become bright red, I could still see the spar, which had decrepitated to a coarse powder, by its faint blue rays. In these cases it was not, however, incandescence but phosphorescence that was taking place. I infer then that all solids, and probably melted metals, shine at the same thermometric point.

The temperature of incandescence seems to be a natural fixed point for the thermometer; and it is very interesting to remark how nearly this point coincides with 1000° of the Fahrenheit thermometer, when Laplace's coefficient for the dilatation of platinum is used. Upon that coefficient the point of incandescence is 1006° F.

In view of these considerations, and recollecting that the number given by Daniell is 980°, and that of Wedgwood 947°, I believe that 977° is not very far from the true temperature at which solids begin to shine. It is to be understood, of course, that this is in a very dark room.

I pass now to the second proposition. The rays emitted by the incandescent platinum were next received on a flint glass prism, placed so as to give the minimum deviation, and after dispersion viewed in a small telescope. A movement could be given to the telescope, which was read off on an annexed scale. However, instead of bringing the parts of the spectrum under measurement to coincide with the wires stretched across the field of the instrument, I found it more satisfactory to determine them by bringing them to one or other of the edges of the field; a process well adapted to ascertain the position of the extreme rays, the faint light of which contrasted well with the darkness by which it was surrounded. They could not have been so accurately seen while the rest of the spectrum was in view; and as it was absolutely necessary to have fixed points of reference, that all the observations might be brought to a common standard of comparison, and as there are no fixed lines in the light of incandescence, such as are in the sunshine and daylight, I therefore previously determined the position of the fixed lines in a spectrum formed by a ray of reflected daylight, which passed through a fissure $\frac{1}{20}$th of an inch wide and one inch long, occupying exactly the position subsequently to be occupied by the incandescent platinum. Fig. 1 represents the results of this observation.

The strip of platinum was now placed in the position of the fissure which had given the spectrum fig. 1, and its temperature was raised by the passage of a voltaic current. Although I could distinctly see the metal when the heat had reached about 1000° by the naked eye, yet the loss of light in passing the prism and telescope was so great that I found it necessary to carry the temperature to 1210° before a satisfactory observation could be made. At this point the spectrum extended from the position of the fixed line B in the red, almost as far as the line F in the green; the colors present being red, orange, and a tint which may be designated as gray. There was nothing answering to a yellow. The first rays visible through this apparatus may therefore be designated as red and greenish gray; the former commencing at the line B, and the latter continuing to F. The magnitude and other relations of this spectrum are given in fig. 3.



Spectra of incandescent platinum at different temperatures.

The voltaic current was now increased, and the temperature rose to 1325°. The red end of the spectrum remained nearly as before, but the more refrangible extremity reached to the position of the little fixed line *d*. Traces of the yellow were now visible; and, with a certain degree of distinctness, I could see red, orange, yellow, green, and a fringe of blue. Fig. 4 shows the result.

The temperature was now carried to 1440°. I thought the red extremity was advancing more to the line A: the blue had undergone a well marked increase. It reached considerably beyond the line G, as shown in fig. 5.

On bringing the platinum to 2130° all the colors were present and exhibited considerable brilliancy. Their extent was somewhat shorter than that of the daylight spectrum, as is seen in fig. 6.

Having thus by repeated experiments ascertained the continued extension of the more refrangible end as the temperature rose, it became necessary to obtain observations for points below 1210°, the limit of visibility through the telescope. I therefore carried the prism nearer to the platinum, and, looking with the unassisted eye directly through it at the refracted image, I found it could be distinctly seen at a temperature as low as 1095°. Under these circumstances the total length could not be compared by direct measurement with the other observations, and the result given in fig. 2 is from the best judgment I was able to form: the colors were red and greenish-gray.

The gray rays emitted by platinum just beginning to shine appear to be more intense than the red; at all events the wires in the field of the telescope are more distinctly seen upon them than upon the other color. I give them the designation of gray, for they appear to approach that tint more closely than any other; and yet it is to be remarked that they are occupying the position of the yellow and green regions.

Already we have encountered a fact of considerable importance. The idea, that as the temperature of a body rises it begins to emit rays of increasing refrangibility, has obviously to be taken with a certain restriction. Instead of first the red, then the orange, then the yellow, &c., rays, in succession making their appearance, in which case the spectrum should regularly increase in length as the temperature rises, we here find, at the very first moment it is visible to the eye, it yields a spectrum reaching from the fixed line B to nearly F: that is to say, equal to about two-thirds the whole length of the interference spectrum, and almost one-half of the prismatic.

It is to be remarked, that while the more refrangible end undergoes a great expansion, the other extremity exhibits a corresponding though a less change. As very important theoretical conclusions depend on the proper interpretation of this fact, we must not forget that, to a certain extent, it may be an optical deception, arising from the increased brilliancy of the light. While the rays are yet feeble, the extreme terminations may be so faint that the eye cannot detect them; but as the intensity rises, they become better marked, and an apparent elongation of the spectrum is the consequence.

It is agreed by optical writers, that to the human eye the yellow is the brightest of the rays. In the prismatic spectrum the true relationship of the colors is not perceived, because the less refrangible are crowded together, and the more refrangible unduly spread out. But in the interference spectrum, where the colors are arranged side by side in the order of their wave-lengths, the centre is occupied by the most luminous portion of the yellow; and from this point the light declines away on one side in the reds, and on the other in the blues, the terminations being equidistant from the centre of the yellow space.

Now if the rays coming from shining platinum were passed through a piece of glass, on which parallel lines had been drawn with a diamond point, so as to give an interference spectrum, even admitting the general results of the foregoing experiments to be true, viz. that as the temperature rises rays of a higher refrangibility are emitted, it is obvious that it by no means follows that the first ray visible should be the extreme red. Our power of seeing that depends on its having a certain intensity. Even when it has assumed that extreme brilliancy which it has in a solar beam it is barely visible. We ought, therefore, to expect that rays of a higher refrangibility should first be seen, because they act more energetically on our organ of vision; and, as the temperature rises, the spectrum should undergo a partial elongation in the direction of its red extremity.

I may here remark, that the general result of these experiments coincides exactly with that of M. Melloni respecting heat at lower thermometric points. In his second memoir,* he shows that, when the rays from copper at 390° and from incandescent platinum are compared by transmission through a rock-salt prism, as the temperature rises the refrangibility of the calorific emanations correspondingly increases. Those philosophers who regard light and heat as the same agent, will therefore see in this coincidence another argument in favor of their opinion.

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* Taylor's Scientific Memoirs, vol. i. p. 56.

In view of the foregoing facts I conclude, that, *as the temperature of an incandescent body rises, it emits rays of light of an increasing refrangibility;* and that the apparent departure from this law, discovered by an accurate prismatic analysis, is due to the special action of the eye in performing the function of vision.

As the luminous effects are undoubtedly owing to a vibratory movement executed by the molecules of the platinum, it seems from the foregoing considerations to follow, that the frequency of those vibrations increases with the temperature.

In this observation I am led by the principle, that "to a particular color there ever belongs a particular wave-length, and to a particular wave-length there ever belongs a particular color;" but, in the analysis of the spectrum made by Sir D. Brewster by the aid of absorptive media, this principle is indirectly controverted; that eminent philosopher showing that red, yellow, blue, and consequently white light, exist in every part of the spectrum. This must necessarily take place when a prism which has a refracting face of considerable magnitude is used; for it is obvious that a ray falling near the edge, and one falling near the back, after dispersion, will paint their several spectra on the screen; the colors of the one not coinciding with, but overlapping, the colors of the other. In such a spectrum there must undoubtedly be a general commixture of the rays; but may we not fairly inquire whether, if an elementary prism were used, the same facts would hold good? or, if the anterior face of the prism were covered by a screen, so as to expose a narrow fissure parallel to the axis of the instrument, would there be found in the spectrum it gave every color in every part, as in Sir David Brewster's original experiment? M. Melloni has shown how this very consideration complicates the phenomena of radiant heat; and it would seem a very plausible suggestion that the effect here pointed out must occur in an analogous manner for the phenomena of light.

(To be continued.)

Apparatus for the Fusion of Iridium or Rhodium, or masses of Platinum less than five ounces in weight. By Professor ROBERT HARE, M. D.

An account of the apparatus for the fusion of platinum on a large scale was recently published in this Journal. On the republication of that account in Silliman's American Journal of Science, it occurred to the author to give an account of some smaller apparatus which it is proper to employ for fusing small masses, whether of platinum, of iridium, or rhodium. This addition is now subjoined.

For the fusion of either iridium or rhodium or masses of platinum not exceeding the weight of half an ounce, an instrument with three jets has been employed, the bore of each jet pipe being such as not to admit a wire larger than the $\frac{1}{32}$ of an inch in diameter. The flame produced by these means was quite sufficient to envelope the mass to which it was applied.

In fusing any lumps or congeries of platinum, not exceeding five ounces, an instrument has been used capable of giving seven jets of gas, issuing, of course, from as many pipes. Of these pipes, six protrude through the brass casting forming the bottom of the copper case constituting the refrigerator, so as to be equi-distant from each other upon a circumference of three-fourths of an inch in diameter, the seventh protruding from the centre. The bores of these jets are such as not to admit a wire larger than $\frac{1}{32}$ of an inch in thickness. Those of the larger instruments, represented by the accompanying engravings, (See page 196, vol. 13, March, 1847,) were such as to admit wires of $\frac{1}{24}$th of an inch in thickness.

The jet pipes may be made by the following process:—A thin strip of sheet metal, somewhat wider than the length of the circumference required in the proposed pipe, after being roughly turned about a wire so as to form an imperfect tube, is drawn through several suitable holes in a steel plate, as in the wire-drawer's process. Under this treatment the strip becomes converted into a hollow wire; the edges of the strip being brought into contact reciprocally, so as to leave only an almost imperceptible crevice. Having drawn one strip of platina in this way, another strip sufficiently wide nearly to enclose it, is to be drawn over that first drawn; care being taken to have the crevices left at the meeting of the edges on contrary sides. The compound hollow wire or tube thus fabricated, is finally to be drawn upon a steel wire of the diameter of the requisite bore.

The following method of making jet pipes, though more difficult, is preferable; as there is less liability of the water of the refrigerator leaking into the bore:

Select a very sound and malleable cylinder of platinum, of about three-eighths of an inch in thickness, perforate it by drilling in a lathe, so that the perforation may be concentric with the axis. A drill between $\frac{1}{16}$th and $\frac{1}{8}$th of an inch in diameter may be employed. In the next place the cylinder may be elongated by the wire-drawing process, until the proper reduction of metallic thickness is effected, the diameter of the bore being prevented from undergoing an undue diminution, by the timely introduction of a steel wire.

Of course, the metal must be annealed, as often as it hardens, by drawing. For this purpose, a much higher temperature is necessary in the case of platinum, than in that of either copper, silver, or gold.

The annealing is best performed by the hydro-oxygen flame. If charcoal be used, the greatest care must be taken to have the fireplace clean.

Agreeably to a trial made last spring, palladium may be used as a solder for platinum; and as it is nearly as difficult to fuse as this metal, it is of course, for that purpose, preferable to gold where great heat is to be resisted. No doubt, by employing palladium to solder the exterior juncture of the double drawn tubes above mentioned, they might answer as well nearly as when constructed of solid platinum.

This idea has been since verified by a successful trial; and, moreover, silver has been found to answer as solder for the portions of the tubes protected by being within the cavity filled with water. The exterior or protruding portions of the tubes, may be left unsoldered.

Vulcanized India Rubber Springs.

At the meeting of the Society of Arts, on the 14th inst., a paper was read "On Fuller and De Bergue's Vulcanized India Rubber Springs for Buffers, &c." The application of caoutchouc, or India rubber, to railway purposes, has of late years occupied, more or less, the attention of scientific men. Possessing, as this material does in a very high degree, the properties of flexibility and elasticity united with great tenacity and power of resistance under heavy pressure, its adaptation to various important and valuable purposes in mechanics was too obvious to have escaped notice; yet its liability to become hard and rigid when exposed to severe cold, and on the other hand soft and clammy under the influence of heat, were serious drawbacks to its extensive application; and it was not until very recently that the method of preparing it, by a patented process termed "vulcanizing," has imparted a value and importance to this simple material which is likely to lead to its much more extensive adoption in this and other departments than has hitherto been known. The process referred to, (and which is now pretty generally understood,) consists principally in the admixture of sulphur and some other ingredients at a high temperature, (see Hancock's patent, granted in November, 1843,) by which perfect elasticity is obtained, and non-liability to be affected by any heat or cold of climate. The present invention, for which a patent was granted in October, 1845, is for the application of the material above described for the purpose of buffer and other springs of railway carriages, according to various modes therein specified, and of which we shall now proceed to furnish a description. Instead of the steel springs, as at present, the patentees use a succession of rings or discs of India rubber of various diameters, from 4 in. to 6 in., according to the position and strength required, and from 1 in. to 2 in. in thickness. These are placed on the buffer-rod, (which passes through the centre,) and are separated by thin iron plates; each plate is provided with a conical collar, which serves to keep the India rubber firmly in its place, and at the same time admits of free expansion and contraction without coming into contact with the rod.

The advantages attending the use of this material over steel are numerous and striking. In the first place, their weight being scarcely a tenth part of that of steel, they may be placed in any part of the carriage, whilst the saving of weight in a long train (amounting to several tons) will, to some extent, economise the locomotive powers. Next we have their extreme simplicity, and the impossibility of their being damaged or broken, even in a collision. An opportunity occurred of proving this a few weeks ago, when an engine fitted with these buffers ran off the line near Hull, the iron-work being considerably damaged and broken, but the rings altogether unhurt. Another advantage in these springs is, the greater ease with which they are acted upon at first starting, being at the outset more flexible and yielding than steel; whilst the power accumulates so rapidly under pressure as to prevent the possibility of the buffer-head being brought to a dead hard stop, the benefit of which in concussions is sufficiently obvious. Another important and distinct advantage is the facility with which their power may be regulated. · It will be evident, on inspecting one of the larger rings, that its power of resistance will be in proportion, first, to its diameter, (or, more strictly speaking, to its superficial area,) and next to the proportion which such diameter or area bears to its thickness; thus, a ring of any given diameter or area, 3 in. thick, would be much more easily acted on and reduced to half its bulk than one of 1½ in. thick. The convex form taken by the India rubber being in the latter case much more sudden, and requiring the exertion of nearly double the power. From this it will be at once evident that, by employing a greater number of separating plates in any given distance, you have the power of regulating these springs to the greatest exactness. The patentees state that the price of these springs (including patent right) will not exceed that of steel, but will probably be something less. Several engines and tenders have been fitted with these buffers at Wilson's Foundry, Leeds, and are now in daily successful operation on different lines. Several others are in course of erection at the manufactories of Messrs. Hick & Co., Bolton; Messrs. Sharpe & Co., Manchester; and Messrs. Lawson & Sons, Leeds. Several carriages have also been in daily use on the Great Western line for some months past, and are very highly spoken of. Upwards of 50 are being constructed at the works of Messrs. Fox, Henderson & Co., near Birmingham, for the Marie Antonia Railway, under the superintendence of Mr. Brunel. Experiments, as to the exemption of this material from being affected by the severest frost, have been made by the patentees during the past winter at St. Petersburgh and other parts of the continent, the results of which are quite conclusive. Many of the rings have also been subjected to a pressure of 60 to 100 tons, and reduced to the thickness of 1-16th of an inch without the slightest damage, resuming their shape immediately on the pressure being removed. One of the largest was lately put under Nasmyth's steam hammer, and after receiving more than 200 blows, remained equally uninjured. They are also about being applied as bearing springs, both for engines, tenders, and passenger carriages. Lond. Min. Jour.

The National Economic Gas Burner.

We have lately had an opportunity of testing the superiority of this new burner, which gives out a most brilliant light, perfectly white down to the lowest point of ignition, and which is, consequently, a sure test of the perfect combustion of the gas, the proceeds given off being merely the union of the oxygen of the air with the hydrogen, to form the vapor of water, and with the carbon of the carburetted hydrogen forming carbonic acid. By the side of an Argand, a jet, or a bat's-wing, proceeding from the same double branch, the effect is most striking, and clearly evinces the true philosophical, although simple, principles on which it is constructed. The annexed is a diagram and description of the burner. Fig. 1 is a sectional elevation of burner and glass: A the gallery; B the glass, which gradually swells out from the circular burner in the manner shown, to suit the form of flame; C is the supply-pipe, from which spring two branches, *c*, *c*, surmounted by the circular burner, D, which has a certain number of orifices round its upper surface, similar to an Argand. The main principle of this invention is the button and stem E, which is screwed into the supply-pipe, as shown in the figure; the button is of brass, and the stem of iron, both solid, and by this application, the gas in rising through the supply-pipe, forms itself into a hollow cylinder, and becomes considerably heated in its passage upwards, and thus rendered more easy of combustion. Fig. 2 is the button and stem shown on a larger scale, F being the stem, and E the button fitting by a small orifice on to the small part of the stem at *f*. The inventors claim for it a saving of from 30 to 40 per cent. over other burners. Ibid.

Fig. 2.

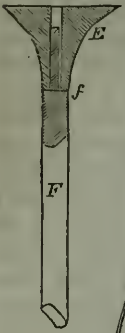
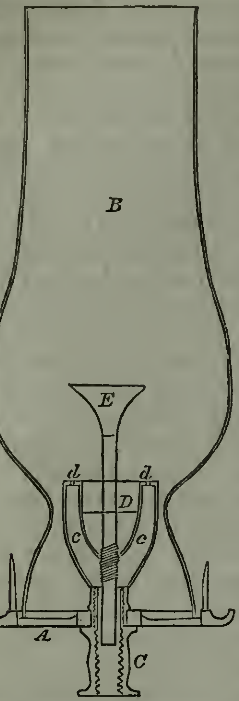


Fig. 1.



Important Experiments with the Gun Cotton.

A series of trial experiments, to test the strength of gun-cotton in blasting, as compared with the known powers of gunpowder, took place on Wednesday, in the Standedge tunnel on the Huddersfield and Manchester Railway. A correspondent thus describes the proceedings, and their results: The place selected for the experiments is in the midst of the great Yorkshire chain of hills, between Huddersfield and Manchester, where a tunnel is now constructing through huge masses of millstone grit, and which, when completed, will be the longest tunnel in England. The rocks, which are situate at a depth of 145 yards below the surface of the mountain, consist entirely of close grained quartz—of which some idea may be formed by the fact, that in 110 yards of the tunnel now completed, not one fissure or joint is perceptible. Holes were drilled of 2 in., 1½ in., and 1¼ in. in diameter in the millstone grit, and the charges of gun-cotton varied from 1-6th to 1-3d of the weight of powder ordinarily made use of in blasting. Cartridges containing the gun-cotton were dropped into the holes, with the patent fuse attached—and the quantities varied from 10 ozs. in the larger, to 6 ozs. in the smaller tubes; the quantity of gunpowder employed for similar blast-drills, varying from 1 to 3 lbs. The shots in the tunnel were 12 in number, 10 being charged with gun-cotton, and Nos. 4 and 11 with gunpowder. The shots numbered 2 and 7 in the south heading, and 12 in the north heading, were declared by Mr. Nicholson, the contractor, previous to their being fired, to be those on which the test of the strength of gun-cotton, compared with that of gunpowder, would be most certain, both as to charges and position. No. 2 was charged with 10 ozs. of gun-cotton, and did wonderful execution, exceeding in everything the expectations of both the engineers and miners. No. 7 was charged with 1¼ oz. of gun-cotton, and performed the same work as 6 ozs. of gunpowder. The crowning experiments were Nos. 11 and 12 in the north heading. No. 12 was charged with 16 ozs. of gun-cotton, against 3 lbs. 4 ozs. of gunpowder in No. 11, the shots exceeding anything the engineers or miners had before tested. The gun-cotton exploded first, and threw against the side of the heading, and broke into nine pieces, 220 cubic feet of rock, or about 15 tons weight. This shot, from its connexion with No. 11, was supposed to have assisted it materially. No. 11 removed to the distance of about one yard 224 feet of rock, or about 16½ tons weight, but was broken into six pieces only: thus showing the strength of the one over the other. The following properties were established in these experiments:—That the gun-cotton may be considered of three or four times the strength of gunpowder; that it is entirely free from smoke—a qualification of great importance in mining operations, as the miners can recommence work immediately after the blasts have been fired, which is not the case with gunpowder; that, in keeping the cotton on the works, and its being handled by the men, there is not so much risk from explosion, or loss from waste, as with gunpowder; that it ignites with more certainty than gunpowder; and, from the decreased size of the charge, the depth of the drill-hole may be diminished, and the power more concentrated; it also possesses all the qualities of the best gunpowder, and may be kept under water instead of in a magazine—it does not heat by keeping, and will explode at not less than 350.

Ibid.

Another New Planet.

From the London "Evening Mail" of July 12, 1847.

TO THE EDITOR OF THE EVENING MAIL.

Sir:—Hoping that the weather would have enabled me to accompany it with this night's meridian observations of the new planet, whose discovery, I doubt not, it announces, I have delayed transmitting you, till the last moment, the following copy of a letter, which I received this afternoon from Professor Schumacher:

"*Altona, July* 6.

"My Dear Sir:—Mr. Hencke, the discoverer of Astræa, writes me that he has found a small star, that, indeed, seems to be a new planet. I have received his letter so late, that there is no more time to day to print the circular; so, till next Friday, you must be content with this previous notice. I subjoin his estimated places.

Believe me, my dear sir, yours very truly,

H. C. Schumacher.

"The star is of the ninth magnitude. Its estimated places, using Hour XVII of the Berlin maps, are—

	h.	m.		Right Ascen.	South Declin'n.
July 1	10	15	(mean time,)	257° 7′	3° 48′
" 3	11	45	" "	256° 40′	3° 51′

Perhaps, however, I may add, from the above data, the approximate places of the planet for the next four nights, at about 11 o'clock, mean time, at London.

	R. A. h. m. s.	*S. D.* deg. m. s.
July 9,	17 1 22	4 14 24
" 10,	17 0 29	4 18 18
" 11,	16 59 36	4 22 12
" 12,	16 58 43	4 26 6

The star lies nearly midway between Zeta and Gamma Ophiuchi; it is not in a very rich part of the heavens, has an hourly motion of about two seconds of time in right ascension, and of about ten seconds in declination, so, on a fine evening, it will be found without much difficulty.

J. South.

Observatory, Kensington,
Friday night, ¼ past 10, July 9.

From the same paper of July 14.

The New Planet.—We received yesterday, the *Universal Prussian Gazette* of Wednesday last, which contains the following official astronomical information respecting the new planet, in addition to that with which Sir J. South favored us yesterday:

"*Berlin, July* 6, 1847.—On the 1st inst., at 10h. 30m. P. M., the discoverer of Astræa, M. Encke, of Driessen, discovered a second star, not previously marked on his map, of about the 9th degree of magnitude, in 257° 6′ 7″ right ascension, and 3° 42′ 5″ southern declination. On the 3d inst., at 11h. 45m. P. M., it had retrograded to 256° 40′ right ascension, and 3° 51′ 5″ southern declination. These data refer to the equinoctial, which forms the basis of the academical celestial charts, one of which may serve for the purposes of investigation. According to the information afforded by M. Encke, the new planet, (for that it is such there is every probability,) was observed on the 5th of July, from the observatory in this city, on the meridian and in the refractor. The first gives the place as follows: Date, July 5; time, 10h.

48m. 28s.; right ascension, 256° 51′ 34″·5; south declination, 4° 8′ 27″·8. A comparison, made about three hours later, shows that the right ascension is daily diminishing by about 12 minutes and the southern declination, increasing about 6 minutes. The star is about the ninth degree of magnitude, and probably belongs to the smaller planets.

(Signed) ENCKE."

In the next number of the *Mail*, we find the following elements of the new planet.

SIR:—I forward to you the elements of the new planet, based upon the Berlin observation of July 5, and two accurate micrometrical observations, made here on the evenings of the 10th and 14th.

Epoch 1847, July 0.0, Greenwich M. T.

Mean anomaly,	283°	56′	54″·0	
Longitude of perihelion,	8	17	24 ·1	M. E.
Ascending node,	137	25	35 ·1	July 0.
Inclination,	15	2	56 ·1	
Angle of Eccentricity,	13	49	20 ·0	
Log. semi-axis major,	0·4016899.			
Siderial period,	4·004 years.			

From these elements I have calculated the following ephemeris, which will probably be of some assistance to your astronomical readers, until we have obtained further observations for the corrections of the elements. The positions are given for 0h. M. T. at Greenwich.

	Right Ascension.			South Declination.			Log. Distance from Earth.
July 18,	16h.	59m.	6·3s.	5°	35′	39″	0·2140
" 21,	16	57	42·7	5	59	22	0·2183
" 24,	16	56	33·9	6	23	58	0·2229
" 27,	16	55	40·5	6	49	20	0·2279
" 30,	16	55	2·7	7	15	22	0·2331

The orbit is very similar to that of the planet Juno.

I remain, sir, yours, very respectfully, J. R. HIND.

Mr. Bishop's Observatory, Regent's Park, July 15.

Observations on the above Planet, made in the United States, at the Philadelphia High School, State of Pennsylvania.

HIGH SCHOOL OBSERVATORY, Aug. 6, 1847.

To the Editors of the North American and U. S. Gazette.

GENTLEMEN:—During a temporary absence from the city, my attention was called, by an article in the New York Herald, to the recent discovery of Hencke's second asteroid, at Driessen, on the first day of July last. On arriving in this city to-day, I learned that Mr. Russell Hinds' Elements and Ephemeris had been published in the Evening Mail, London, July 19th, and received in this city, and that the new asteroid had been observed on the nights of the 4th and 5th, at our Observatory, by Mr. Sears C. Walker, assisted by Messrs. Reynolds and Mason. It is of the ninth magnitude, and perfectly resembles a fixed star. I subjoin Mr. Hinds' Elements of the sixth Asteroid of our system. Its name has not yet reached us.

Epoch July 0, 1847,	283°	56′	54·0″	m. noon Gr'h.
Perihelion point,	8	17	24·1	m. eq. July 1.
Ascending node,	137	25	35·1	
Inclination,	15	2	56·1	
Angle of eccentricity,	13	49	20·0	
Mean distance,	0·4016899			
Siderial period,	4·004			

The following Ephemeris from Mr. Hinds' Elements, (corrected by Mr. Walker's observations,) will serve to point out the place of this new Asteroid in the heavens. The date is for mean noon Greenwich.

	Planet's Right Ascension.			Planet's South Declination.		
August 2,	16h.	54m.	21s.	7°	56′	24″
" 5,	16	54	17	8	23	32
" 8,	16	54	18	8	51	4
" 11,	16	54	45	9	18	54

The Elements of Mr. Hinds were computed from Encke's observation of July 5th, and Mr. Hinds' of July 10th and 14th. They resemble those of the Asteroid Juno. Mr. Walker's corrections of the Ephemeris here applied, are a diminution of twenty seconds of time in right ascension, and an increase of fourteen minutes of arc in south declination.

Mr. Hencke is the only astronomer, except Olbers, who has had the good fortune to discover two planets.

Respectfully yours, E. Otis Kendall.

New Comet.

M. Mauvais discovered, on Sunday night, about 11 o'clock, a new telescopic comet, between the constellation Cepheus and the Lesser Bear. It is composed of a nucleus tolerably distinct, announced by a nebulosity, extended on one side by a tail. The position of this comet was, on July 4, 1847, at 13h. 35m. 50s., average time, right ascension, 22h. 8m. 13s.; northern declension, 80° 26′. Galignani.

On the Use of a Mixture of Spirit of Wine and Camphine, as a Light for Optical Purposes. By John George Children, Esq., F. R. S.

I have lately assisted a friend in getting up an apparatus for dissolving views, &c., on a scale too large for sufficient illumination by the best Argand lamp, and we considered condensed hydrogen gas as too dangerous an agent for a plaything; especially in private houses in the country, where much must be left in the preparation of the gases, &c., to servants unused to such duties. We set to work, therefore to find a substitute that might answer our purpose; and, after a few trials, we obtained a tolerable light, by throwing the flame of spirit of wine on a surface of quicklime, by a current of oxygen gas, something after the manner of Lieut. Drummond's original experiment.* The illumination by the flame of spirit of wine alone, however, proved to be too feeble; but, by mixing a portion of camphine (spirit of turpentine) with it, (which readily dissolves in alcohol,) in the proportion, by measure, of one part of camphine to eight parts of spirit of wine, of the specific gravity of ·841 at 60° F., (equivalent to the spirit of commerce at 60°,) we obtained a light amply sufficient, not only for my friend's dissolving views, but also for his microscope and physioscope, and perfectly free from all danger, or even possibility of explosion. My friend's screen is about 22 × 18 feet; and if it were twice as large, the light is quite capable of illuminating it brilliantly; and it shows a microscopic object, magnified from half an inch to thirty feet, or 720 times, linear, with great distinctness and beauty. I do not mean, that our toy can be compared to the almost solar intensity of the oxy-hydrogen light, also invented by the late Lieut. Drummond,† and now in common (too common?) use; but in a trial I made the other day, in Francis Street, with an apparatus hastily put together for the purpose, by Mr. Collins, I found its effect, measured by one of Wheatstone's photometer's, equal to that of seventy-six of Brecknell & Turner's best platted wick wax candles; and in several trials with our own apparatus, more carefully arranged, and with thoroughly well and recently burnt lime, (an essential caution,) we have found it quite equal to 108 of the same candles, and, on one occasion, to 120! The oxy-hydrogen light at Mr. Collins's, which was splendidly brilliant, being compared in the same manner, was found equal to 121 of the same candles.

In these experiments, no portion of the rays from either of the lights was intercepted; our object being to ascertain the comparative illuminating power of their entire surfaces, and not their comparative intensities only.‡

Were it not for the peculiar odor of the so-called naphtha, or coal-oil, which, to some persons, is highly offensive, even in its purest state, it might, when highly rectified, be advantageously substituted, in an economical point of view, for the spirit of wine. Four ounces of camphor, dissolved in a pint of that liquid, gives, under the same circumstances, nearly as brilliant a light as the spirit and camphine.

The light from camphine alone is, for a few seconds, intensely brilliant, but it is soon quenched in the enormous mass of unburnt carbon, which partly condenses on the lime, and partly escapes into the atmosphere, filling the whole apartment with a dense and almost suffocating cloud of floating black particles. A sufficient and well-regulated supply of oxygen gas might, perhaps, remedy this defect.

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* Philosophical Transactions, 1826, p. 330. Drummond's object and ours were somewhat different. He wanted to get an intense but small sphere of light, "adapted to the nature of a (parabolic) reflector:" we also wanted as intense a light as we could obtain, but, as we could not advantageously use a reflector, one which should likewise extend over a much larger surface.

† Philosophical Transactions, 1830.

‡ Some attempts, indeed, were made in Francis Street, to compare the intensities alone; but the apparatus, from want of time to prepare a better, was too imperfect to allow me to place any confidence in the results. As far as they went, they were greatly in favor of the superior *intensity* of the oxy-hydrogen light. I hope to repeat the trials with a more refined apparatus.

Our apparatus consists of a copper lamp, with two tubes, lying close together, and each containing a wick formed of flat cotton, rolled up into a cylinder; and a cylinder of lime, about three-eighths of an inch long, and one-eighth of an inch in diameter, inclosed in a thin copper case. The pipe conveying the oxygen gas from the gasometer, terminates in a small jet, inclining upwards, which lies between the two wicks, slightly parted to receive it, and within rather less than one-eighth of an inch from the circular disc of lime, and about one-fourth of an inch above the lower edge of the copper case. We find that the common chalk of this neighborhood, furnishes a lime, which gives a better light than that from the Bristol, or any other limestone we have tried.*

Halstead Place, Feb. 13, 1847. Lond. Edin. & Dub. Mag.

High Temperature of Mines. By ROBERT WERE FOX.

The temperature of some of the deeper parts of the United Mines† has long been observed to be remarkably high; and it has greatly increased with the increasing depth of the excavations.

Captain Youren, one of the agents of the mine, informs me, that near the eastern extremity of the deepest level, on the "*middle lode,*" there is a spring or jet of water, discharging about 94 gallons a minute, at the temperature of 106⅓°‡ Fahrenheit. This level is 250 fathoms below the surface, and about 200 fathoms under the level of the sea. The "lode" has an underlie or dip of about 2½ feet in a fathom towards the north, and the water flows from its *northern* or *upper wall;* whilst from the opposite side, or *southern wall* of the lode, at the distance of only 3½ feet, there is another spring, discharging 30 gallons of water in a minute, at the temperature of 97¾° Fahrenheit. The air near both these springs was found to be at 104¼° Fahrenheit: and "*killas*" is the only rock which has been seen within 30 fathoms of them. Granite occurs at a considerable distance westward of the place; and two "elvan courses" traverse the mine in nearly the same E. and W. direction as the lode.

I have found that ¼ of a pint of the water from the warmer spring, contained 15 grains of saline matter, consisting of muriate of lime and common salt—in about equal proportions, with a trace of sulphuric acid, probably combined with lime. In the same quantity of the cooler water, only 10½ grains of muriate of lime and common salt were found, the latter in less proportion than the former,—and in this water also there was a slight trace of sulphuric acid. In both instances, the water was clear,—saline to the taste,—and without any metallic salt.

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* Drummond also obtained the most brilliant light from chalk lime.

† This mine, (for it is one concern,) continues to produce abundance of copper ore. It is situated in the parish of Gwennap, about eight miles to the northward, or almost N. N. W. of Falmouth, and is several miles from the sea.

‡ The thermometer employed has been carefully compared with a standard one, and found to be ¼ of a degree too high; so that this small amount must be deducted from the results, making them 106·08°, 97·5°, and 104°, respectively.

It may, I think, be inferred from the saline contents of these springs, that they have a common origin or source; whilst their high temperatures indicate their having come from a considerable depth; and the quantity of water they discharge, that the lode, or rocks beneath, must be very pervious to it. In these instances, at least, there are no grounds for supposing that any chemical decomposition of the sulphur ores in the lode, has caused the high temperature of the water, or contributed to it in any degree, seeing that it contains no metallic, and scarcely any sulphate, salt.

The difference in the heat of the two springs may, perhaps, in part, be attributed to the tendency of the warmer currents to rise towards the upper wall of the lode; and, still more, to that of water at a much lower temperature, passing from superior strata down upon the inclined surface of the lower wall, where, mixing with the water rising from below, the temperature becomes modified, as well as the proportion of the saline contents.

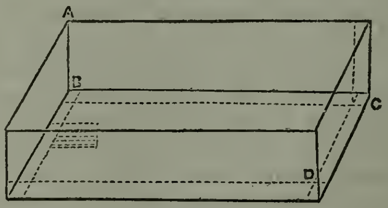
It cannot be doubted that ascending and descending currents of water, more or less copious, and at different degrees of temperature, abound in the veins and fissures of the earth, and often at the junctions of different rocks, and that they must have a great influence in modifying the subterranean temperature, and in different degrees in different places.

Common salt is of rare occurrence in our mines: its presence in the water in question, cannot well be attributed to the flowing of sea-water into the excavation, in consequence of its local or direct pressure; for, if some miles of distance from the coasts did not render this highly improbable, the considerable streams at very high temperatures, and very constant too, (as appears from observations made at different times,) are facts not consistent with such an explanation. If the subterranean jets of water were caused by the inroads of a neighboring sea, we should expect to find them at comparatively low temperatures, and these diminishing in proportion to the duration and amount of the influx.

The salt may, however, have been derived from the ocean, in consequence of the latter penetrating into the earth at its greater depths, or even at its lesser ones, which, under different given circumstances, it may be supposed to do. In either case, the salt water would, from its superior specific gravity, have a tendency to descend through the heated and less saline water in the veins, fissures, &c., where the fluids, becoming gradually more or less mixed and extended in different directions, might ultimately appear in some of our mines, brought up, perhaps, in the largest proportions, by the upward tendency of the more heated currents of water.—*Fourteenth Annual Report of the Royal Cornwall Polytechnic Society.* Lond. Mec. Mag.

Description of a New Mercurial Trough. *By* PROFESSOR LOUYET, *of Brussels.*

In small laboratories, in which one of the chief points to be aimed at is economy, in making researches on gases soluble in water, a small porcelain trough is commonly employed, capable of containing twenty to twenty-five pounds of mercury. The size of the bell-glass is proportioned to the capacity of the trough; thus only small quantities of gas can be collected,—quantities often insufficient for the desired experiments. With a view to obviate this inconvenience, I have modified the mercurial trough, so as to be able, without sacrificing economy, to collect considerable quantities of gas; and I have thought it may be of use to give a description of this new instrument, for the service of persons engaged in particular researches. This apparatus is formed of a small oblong oak box, to the bottom of which is cemented a glass, which fits exactly over its whole extent. The external surface of this glass is carefully polished and prepared. In the centre of one of its small sides, (it is rectangular,) is worked a narrow and deep groove, parallel to the large sides of the right angle. This opening corresponds to a hollow in the bottom of the box. This being done, I arrange the apparatus in the following way, when I desire to collect a gas over the mercury:—I procure bell-glasses, made of emery-stoppered bottles, the bottom of which is removed; the edges of these receivers are prepared and rubbed with emery, and apply accurately to the ground glass, precisely like the receiver of an air-pump. The edges may be very slightly greased, or this precaution may be dispensed with. The receiver is placed on the ground glass, where it is kept fixed with one hand; with the other hand the stopper is removed, and it is entirely filled with mercury; then it is carefully re-stopped. This being done, a small quantity of mercury is poured into the box, so as to fill the small cavity, and to cover its bottom with a stratum of some millimetres. The receiver may now be moved in all directions, and may be slid until it is over the small cavity, into which the extremity of the curved tube by which the gas is disengaged, is adapted. To one of the angles of the box, may be fitted a small pure iron stopcock, by which the mercury is drawn off when the operation is ended. For greater clearness, I subjoin a figure, which represents this new trough of the dimensions which I have adopted.



A B=4½ centimetres.* B C=23 centimetres. C D=17 centimetres.
Depth of the longitudinal groove, taken above the glass plate,=2 centimetres.

Lond. Edin. & Dub. Mag.

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* The centimetre is = 0·393708 of an English inch.

Mines and Steam Power of France.

The *Journal des Debats* has published two important articles on the mineral resources and steam power of France—supposed from the pen of M. Michel Chevalier—some of the chief details of which are here extracted. The statistics are founded on the year 1844. France, it is said, in the order of importance in coal mining wealth, takes the third rank; that is, comes after England and Belgium: in iron she occupies the second place. The absolute and relative consumption of iron and coal in those states in which it is officially known, is thus stated:

Countries.	Coal.	Iron.
England,	*Tons* 23,500.000	1,200,000
France,	5,400,000	480,000
Belgium,	3,200,000	120,000
Zollverein,	3,000,000	300,000

These figures give the consumption per head, in—

England, at	*Kilog.* 870	*Kilog.* 40 75
Belgium,	800	30 —
France,	154	13 71
Zollverein,	107	10 71

In 1844, France reckoned 425 mines of coal, covering about 450,000 hectares; 252 were in work, and 173 remained still in inactivity. The working of the 252 mines, the greater part of which were distributed among twelve principal basins, employed in 1844, 29,554 workmen, and produced 3,055,000 metrical tons of coal, 580,000 of anthracite, and 148,000 of lignite; total of combustible material, 3,783,000 tons, or in kilogrammes, 3,783,000,000. This was about the seventh of the production of England, and a little less than the total Belgian extraction; for, it must be noted, that, in addition to the quantity consumed at home, as before stated, Belgium exported in that year, 1,300,000 tons. Since 1839, the number of the mines worked in France had increased only as 6 to 8; but the extraction advanced from 28 to 30 per cent. Production, however, was still so much in arrear of consumption, as to require from Belgium and England 1,756,000 tons more. It is as yesterday only, so to say, that steam has been employed as a moving power, and yet it already furnishes the globe with a force estimated at more than 10,000,000 of horses, or 60,000,000 of men.—The actual effective force of steam engines in France is thus stated: For purposes of industry, the number is 3645, serving 4214 establishments and manufactories, and representing 45,781 steam horse power, or, at three draught horses per steam horse, 137,340 draught horses. Since 1839, this mechanical material had increased in the proportion of 45 to 50 per cent. The steam engines employed in navigation, form a total of 382 vessels, with a collective force of 12,789 steam horses. The increase under this special head, in six years, has only been from 25 to 30 per cent. The number of passengers transported in 1844, by steam vessels, was 3,287,000, and of merchandize 1,082,000 tons.—The number of the first, compared with 1843, was about stationary, and of the latter, in decrease. The competition of railways would account for the fact. The locomotive machines gave, in 1844, a total of 292; serving 16 lines of railway. Of this number, 168 were of French workmanship, and 124 of foreign origin. This was an increase of 46 machines upon 1843, and of 88 upon 1842. In total, France possessed, in 1844, 4319 steam engines of all sorts, of the collective steam horse force of 62,950, or of 188,847 draught horses, or, at the rate of about six men to one draught horse, of 1,321,929 men. Such is the industrial army which steam now furnishes to France, and, whatever may be written against machinery, we do not find that the employment of this mechanical power has yet left the people bereft of work. Since the last four or five years, the number of steam machines augments rapidly in France, and yet, it is necessary to say, it represents scarcely $\frac{1}{12}$th of the mechanical power employed in England.

Lond. Min. Jour.

Receipts for Cleaning Engravings.

Put the engraving on a smooth board, cover it thinly with common salt finely pounded; pour or squeeze lemon juice upon the salt, so as to dissolve a considerable portion of it; elevate one end of the board, so that it may form an angle of 48 or 50 degrees with the horizon. Pour on the engraving boiling water from a tea kettle, until the salt and lemon juice be all washed off; the engraving will then be perfectly clean, and free from stains. It must be dried on the board or some smooth surface gradually. If dried by the fire or the sun, it will be tinged with a yellow color. Any one may satisfy himself of the perfect efficacy of this method, by trying it on an engraving of small value.

Another plan for cleaning engravings, at least for removing the chief part of that discoloration they may have acquired by age and exposure, and constant use, is to lay the print face downwards, in a vessel large enough to admit the whole lying quite flat; water, boiling hot, is then poured over it, sufficient to cover it to the depth of an inch or more; the print is allowed to soak in the water more or less time, according to circumstances. By degrees, the dirtiness disengages itself from the surface into the water. The print is then taken out and passed through fresh clear water, and held or hung up, for the superfluous moisture to run from it; and when this has sufficiently taken place, it is laid between sheets of white French blotting paper, and covered by a thick millboard, weights being laid on it, so as to have the effect of a moderate press; and it is thus left to dry. Where there is much soiling to be removed, and of old standing, it may be allowable to use, gently and carefully, a soft hair brush, whilst the print is saturated with the water, to assist in the disengagement of the impurities. Of course, throughout the operation, care must be taken in handling the print, lest it should tear, as plate paper is very soft when saturated with water.

An engraving, however soiled by age, smoke, ink, &c., &c., may be speedily restored, by simply immersing it in oxymuriatic acid, permiting it to remain a longer or a shorter time, according to the strength of the solution, or the degree in which the paper of the engraving is stained.

To avoid the trouble of obtaining the acid by distillation, it is an equally effectual method to add one ounce of black oxide of manganese, or the red oxide of lead, to three ounces of common muriatic acid, diluted with water. At the end of two or three hours the acid will become colorless, and may be used after a little further dilution.

A slight deposit of saline crystals will be found on the print after it is removed from the solution, (in which, by the-by, it should remain at least an hour,) which may be discharged by repeated rinsings in pure water. It were as well to add, that the bottle in which the mixture is made should be strong, or its stopper not made very fast, as the elastic vapor extracted on making the mixture may cause an explosion.

London Art-Union.

Description of the Locomotive Engine "Namur."

The "Namur" is a six-wheeled engine, with the whole of the working parts outside.

Diameter of the driving wheels,	7 ft. 0 in.
do. supporting do.,	3 ft. 9 in.
Distance between centre of the extreme wheels,	13 ft. 0 in.
Diameter of cylinder,	16 in.
Length of stroke,	20 in.
Number of tubes,	182
Length of ditto,	11 ft. 0 in.
Diameter of tubes, outside,	2 in.
Length of fire-box,	4 ft. 3 in.
Breadth of ditto,	3 ft. 5 in.
Area of fire grate,	14 ft. 6 in.
Surface in fire-box,	62 ft. 0 in.
Surface of tubes, inside,	927 ft. 0 in.
Total surface,	989 ft. 0 in.

This engine is constructed for the Namur and Liege Railway, and has run on the London and North Western Railway, with every variety of train, a distance of 2300 miles. In the course of the experiments, the following speeds have been reached:—With a train of trucks loaded with coke, and weighing 80 tons, exclusive of engine and tender, 51 miles per hour on a level;—with a train weighing 50 tons, 62 miles per hour was attained, between Tring and Wolverton. But the most severe test an engine can be put to, is when it has no train behind it: an experiment of this kind was tried with the Namur, Capt. Addington, inspector general of railways, and Capt. Simmonds, his assistant, being on the engine at the time, with which a speed of 75 miles an hour was attained on level ground, going round a curve between London and Harrow. The speed was taken by Captains Addington and Simmonds, and both were perfectly satisfied with its steadiness at that rate of speed. A second engine is building for the North Western Railway with 8 feet driving wheels.

Civ. Eng. & Arch. Jour.

Elastic Tire Wheels.

The attention of the visitors to the Parks this week has been much attracted by the appearance, among the crowd of gay equipages, of a brougham with *silent* wheels. The tire of the wheels consists of an elastic tubular ring, made, (we believe,) of caoutchouc, inclosed in a leathern case, and inflated with air to any degree of tightness desired. The motion of the carriage is exceedingly easy. We are informed that it has now gone about a hundred miles, over roads of all sorts, even some that were newly macadamized, and that the outer leathern casing is, (contrary to what might have been expected,) as sound and entire as at first, not exhibiting in any part of it the slightest tendency to rupture. The inventor is Mr. R. H. Thompson, C. E.

Lond. Mec. Mag.

Review of the Mines and Mining Industry of Belgium.

R. Valpy, Esq., (of the Board of Trade,) read a paper on this subject at the meeting of the British Association: it stated that, as a coal-producing country, Belgium ranked the second in Europe. The ratio of the coal district to the total area is—

			Acres.		Tons annually.
Great Britain	$\frac{1}{20}$	or	2,930,000	producing	34,000,000
Belgium	$\frac{1}{2}$	"	335,000	"	4,500,000
France	$\frac{1}{210}$	"	630,000	"	3,783,000
Germanic Union					3,000,000

In 1838, the total number of coal mines in Belgium was 307, with 470 pits in work, and 172 in process of construction, employing 37,171 persons; being an increase of 8454—or 28 per cent.—on the number employed in 1829. The increase of the quantity of coal raised, was not accurately ascertained, but it appeared to be about 37 per cent. The average cost of production is 10s. 8d. per ton, and the average price 23s. 1d. for first quality, and 16s. 6½d. for the second quality of coal; the average rate of wages is 1s. 6$\frac{3}{10}$d. per day. The establishments for preparing other mineral productions for market, in 1838, were—for iron 221, copper 8, zinc 7, lead 2; the total number of furnaces was 139, of which 47 used coke, and 92 charcoal. The total number of accidents from 1821 to 1840 was 1352; which occasioned severe hurts to 882 persons, and deaths to 1710, making a total of 2592 sufferers in 20 years.

Lond. Min. Jour.

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SEPTEMBER, 1847.

CIVIL ENGINEERING.

On the Resistance of the Atmosphere to Railway Trains, and a Means of Lessening the same. By H. BESSEMER, C. E.

The amount of absolute resistance of the atmosphere, to bodies moving through it at high velocities, is still a moot-point, and perhaps in no branch of engineering have we greater discrepancies in opinion, as to the actual loss resulting from this cause. Dr. Lardner, who devoted a good deal of attention to the point in question, arrived at the conclusion, that the atmospheric resistance offered to passenger trains moving at 30 miles per hour, was 15 lbs. per ton of the gross weight of the train, or 1½ times the whole amount of the resistance caused by all the other power-absorbing forces combined. It is easy to see, however, that this mode of calculation must be anything but correct, as the resistance will vary, not according to the greater or less weight of the train, but as the greater or less area exposed to the direct atmospheric resistance, together with the shape of the front or leading carriage. The most generally acknowledged rule is, that at a speed, for example, of 35 miles per hour, the resistance is 6 lbs. per square foot. This is convincingly confirmed by a series of experiments entered into by Mr. Bessemer, who has devoted his attention to this greatly neglected question. He says,

"In my experiments before referred to, I fitted up an apparatus consisting of a horizontal wheel supported by a vertical shaft which was driven by bevel gear, and connected to a steam engine. The horizontal wheel was keyed firmly to the shaft, and carried upon it a second wheel made of wrought iron, and free to move upon the shaft. This second wheel was placed above the first, and supported upon it by small anti-friction wheels of steel attached to the upper one, so that the upper horizontal wheel could revolve with exceedingly little force. One of Salter's spring balances was attached, by its opposite ends, to one of the arms of each wheel, so that the two wheels were made to move in concert, excepting when any opposing force was applied to the progress of the upper wheel, when the spring balance served to indicate the amount of such opposing force. But as the indications could not be read off during the experiment, I attached to the index a pencil tracer and card, so that when the apparatus was at rest, the resistance which had been indicated on the card could be read off.—Matters having been thus arranged, a model carriage of wood, on a scale of one-sixth the size of those in use upon railways, was attached to the light iron wheel, and the apparatus put in motion. The amount of resistance opposed to the passage of the carriage through the air, was ascertained by the wheel on which it was placed moving on its friction rollers, and indicating on the spring balance the number of the pressure. The speed was gradually augmented from the time of starting, in each experiment; and when the number of revolutions per minute was attained, which was equal to the number of miles per hour previously determined on for each series of experiments, the speed was gradually diminished, till the carriage was brought to a state of rest, when the indication on the card was copied off, and the same experiment twice repeated, so as to obtain, in all cases, the mean of three experiments. The first series indicated a resistance of 2·1 lbs. per square foot of front surface of carriage, at 20 miles per hour; a resistance of 3·2 lbs. at 25 miles per hour; a resistance of 4·5 lbs. at 30 miles; a resistance of 6·1 at 35 miles; a resistance of 10·0 at 45 miles per hour. The last was the highest rate of speed which the apparatus was capable of moving at, without danger of derangement; and the resistance at this rate per superficial foot of frontage of carriage amounted exactly to 10 lbs. I took this speed as the basis of my subsequent experiments, because the various pressures, being expressed in round numbers, will impress themselves more distinctly on the mind than if decimals were used. Having thus ascertained that the pressure amounted to exactly 10 lbs., on the end of the model carriage of 1 foot square, a second carriage was placed between the buffers left open, as is the present practice on railways. The two carriages being put in motion, at the selected rate of 45 miles per hour, the resistance indicated as the mean of three experiments, was 14·1 lbs., so that, striking off the decimal, we have 4 lbs. resistance per superficial foot of the second carriage. A third carriage was connected before, and the experiment proceeded with in a similar manner. The indication was now 18 lbs., showing an addition of 4 lbs. for the third carriage. Three more carriages were successively added, and the result in each case was precisely 4 lbs. per superficial foot. A train of six carriages being thus connected, the spring balance indicated 30·5 lbs., but, as before stated, I throw off the decimal, and thus obtain 10 lbs. resistance for the first carriage, and four pounds for each of the five following carriages, making 20 lbs. resistance for the intermediate carriages, or $\frac{4}{10}$ as much pressure on each of the last carriages as was exerted on the first. Having arrived at this important result, the next stage of experiments, and that on which depended entirely the success of the plan I had devised in my mind, for reducing the atmospheric resistance on the ends of the intermediate carriages, was now to be tried. For this purpose, I had five small hoods of wood, made to fit into, and fill up, the intervals between the ends of each carriage. One of these hoods was placed in between the first and second carriages of the train of six, which thereby presented externally the appearance of a double carriage, without any vacancy or space between them, for the atmosphere to impinge against. The train was now brought up to 45 miles per hour, and the mean of three experiments showed a diminution of 4 lbs. in the general resistance. A second space was then filled in, which resulted in another reduction of 4 lbs.; the remainder of the spaces were then successively filled up, with a like result in each case. The train presented, at last, the appearance of one immensely long carriage, without any break or interval to catch the air, and thus arranged, the whole train suffered only a resistance of 10 lbs., being precisely the same as that of a single carriage, and clearly demonstrating, that, in the case of a train of six carriages, $\frac{2}{3}$ of the atmospheric resistance could be saved, by merely filling up the intermediate spaces.

"The next point to be ascertained was, how much farther the remaining 10 lbs. could be reduced: with this view, two more carriages were constructed; the ends were of a wedge form, like the bow of a ship, that is, the floor and roof of the carriage were pointed like the bow, while the sides of the carriage were left perpendicular, thus forming a sort of equilateral triangle, with its base attached to the parallel sides of the carriage. It was my intention to place one of these carriages at the fore, and the other at the after part of the train; one of them was accordingly placed in front, and the train brought to a velocity of 45 miles per hour. The pressure indicated, was now reduced from 10 lbs., to 6·3 lbs., although seven carriages were used. This was the first of three experiments intended to be made to get a mean, but, unfortunately, in the second experiment with these seven carriages, the centrifugal force was so enormous, that one of them became detached, and abutting against a side wall, formed a solid obstruction to all the rest, and the result was the destruction of the whole train of carriages. I was thus prevented from making the farther trial with the wedge-shaped carriage placed at the stern. I had intended to put my apparatus again in order, for the purpose of trying this last-named experiment, and also with a view of ascertaining the most advantageous form of wedge, but pressure of business prevented this being done at the time, and I have not since had leisure to resume the inquiry. However, I have clearly demonstrated this much—that the resistance of the atmosphere to railway trains, is exerted on the ends of each of the carriages forming a train, and amounts, in each case, to $\frac{4}{10}$ of the power exerted on the first; and also, that, by filling the intermediate spaces between the carriages, this pressure on them will be most materially diminished."

The care with which these trials have been conducted, leaves no doubt as to the accuracy of the results; their tendency will, no doubt, be to induce practical engineers to probe deeper into the details of the best forms for carriages, with a view to the diminution of the propulsive power, so ably discussed by our author. The experiment of the filling up of the spaces between the carriages, opens up to us consequences of a more serious aspect than we were before aware of. Mr. Bessemer appends a series of tables, setting forth the diminution of the resistance, with his wedge-shaped carriages, and filled up spaces, as compared with the widely separated, and flat fronted ones of the ordinary construction; the loss of power, in the latter case, being based upon the observations both of Dr. Lardner, and Mr. Robert Stephenson. According to the formula of the latter gentleman, the resistance of three trains, of 10, 15, and 20 carriages respectively, moving at 35 miles per hour, with a gross weight of 40, 60, and 80 tons, experiences a detrimental resistance, including all sources, of 1200, 1800, and 2400 lbs., whilst, by the use of Mr. Bessemer's modified carriages, the same conditions are represented by 574,781, and 986 lbs. of total resistance. In the express trains, where the speed is increased to 60 miles per hour, the total opposing forces amount to 2800 lbs., while the author contends that his proposed practice would reduce this down to 922 lbs., or less than one-third.

The mode in which he proposes to effect the filling up of the spaces between each carriage of the train, is clever and easy of application. Each end of the carriages is fitted up with a hood, or flexible covering of leather, or gutta percha, similar to the ordinary collapsible coverings of pleasure carriages. The frame of the hood is attached, by hinges, to the projecting head of the buffer, and is strengthened from within, by suitable diagonal braces. The whole may be brought into a small compass, when out of use, by the joints, which permit the upper ends of the supporting frames of the leather to fall inward, towards the end of the carriage. With reference to the absurd practice of crowding the carriage roofs with luggage,* Mr. Bessemer remarks very pointedly:—

"From what has been said, it will be clear, that the practice of putting luggage on the roofs of the carriages, is a most preposterous mode of conveyance. Take, for example, a portmanteau three feet in length, by one foot high, presenting a surface of 3 superficial feet: at 30 miles per hour, this gives a resistance of 13·5 lbs., and assuming, as before, (which is really more than ample,) that 10 lbs. will draw a ton, we have a resistance, caused by this single portmanteau, equal to a weight of 2880 lbs. inside the carriage! And if we apply this rule to express trains, moving at 60 miles per hour, the resistance increasing as the square of the velocity, we have 2880—2 × 2·11520 lbs., or little more than 5 tons, as the equivalent load inside the carriage. According to the method I have proposed, of closing up the spaces between the carriages by elastic hoods, these will form convenient space for the stowage of luggage, and where they would be secure from rain or dust."

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* This mode of carrying baggage is not practised in the United States—here it is all carried in a separate car, and under lock and key.

Glasgow Prac. Mech. & Eng. Mag.

The Late Failure of the Chester Bridge.

The newspapers of the day will have informed our readers of the primary details of this lamentable occurrence. A variety of opinions exist as to the true cause of the giving way of the girders, but the results are quite sufficient to place us on our guard against too great a reliance upon Cast Iron employed in the manner it is here. The account of the accident, as furnished by a resident in the locality, is as follows:

The Chester and Holyhead Railway is carried along from the Chester station, by the side of the Roode, on a handsome viaduct, and crosses the River Dee at the extremity of the Roode, nearer the city than the celebrated one-arch stone bridge, erected by Harrison, of Chester, over that river, at the other side of the Roode. The Dee railway bridge is a flat-girder bridge of iron, divided into three spans by two massive stone piers, at equal distances in the stream; and each span is formed of three lengths of cast iron beams or girders, joined together with bolts, with a semi-circular iron cap over each joint, and the beams being further trussed on the sides by tension or suspension rods, consisting of a number of parallel wrought iron plates. The beams or girders are in the rib of 2 in. metal; in the flange 2½ in. Each beam weighs probably 30 tons. Like the Menai suspension-bridge, this one has, or rather had, two roadways, the one used for the up trains and the other for the down trains; and each roadway was carried over the river on two parallel lengths of the beams we have been describing. The roadway and rails used for the trains from Ruabon, &c., to Chester is still entire and uninjured; that used for trains from Chester to Ruabon is uninjured for two-thirds of its length (viz., the two spans nearest Chester), and for the remaining third, only one of the two parallel beams supporting the roadway (viz., the outside one next to Roode) has given way, the other remaining apparently uninjured. The length of beam between the abutment and the next pier (95 ft. span) has three joints in it, and each joint is secured in various ways, viz., by bolts, lugs underneath it, with clips, &c. The accident was seen by a little boy who was fishing in the river, on the Wrexham side, near the bridge. Hearing a train coming, he naturally looked up, and on its crossing the span nearest to him, he heard a crashing noise for two or three seconds, and then, as he says, he saw the four carriages come down into the river "in a string." From the rails to the surface of the water, at the time of the accident (in the then state of the tide), is a distance of about 30 ft. (and not, as some accounts have stated, 120 ft.) The account of Clayton, the engine-driver, the only individual on the train who passed over safely, is as follows:—When passing over the third span from Chester, he felt the rails sinking beneath him, and he instantly put on the steam, and then felt the carriages severed, while the engine and tender cleared the bridge, and reached the abutments on the Wrexham or south banks of the river in safety; but the jerk or wrench arising from this severance threw the tender off the rails, inclining it sideways towards the stone parapet; and by the marks of the tender's paint upon the stone, and the friction caused by the stone on the timber of the tender, its course whilst literally riding on the upper part of the parapet may be plainly traced. The tender was finally thrown somewhat on its side, and about three feet off the rails, on the east side; this shock severing it from the engine, the iron bar or hook connecting them being snapped in two. The stoker, whose name is Anderson, was by this shock thrown off the tender upon the rails, and the screw-jack from the tender falling upon him, killed him on the spot. The engine continued its course along the line, and, fortunately, Clayton, the engine-driver, escaped without hurt. His conduct in this trying and perilous position seems to have been most praiseworthy, displaying great coolness, intrepidity, and presence of mind. He proceeded to the first "points," and there gave the alarm; and then went on to the Saltney station, and there obtained the assistance of a number of men who were repairing the road, and who at once hastened to the spot. Clayton then piloted his engine back, on the other line of rails; and, notwithstanding the fearful catastrophe which had just before occurred, he boldly recrossed the bridge, and communicated the fact of the accident at the Chester station. The bridge and river presented a singular spectacle after the accident. The whole of the easterly roadway between the south abutment and the next pier had fallen, that portion of the beam next the pier resting its upper part against the pier, the lower part in the river; and the upper course of masonry of both pier and abutment had been carried down by the beam in its fall. The three carriages and the van were lying, much smashed, in the river; and the south bank was covered with fragments of the roadway (which was laid on transverse wooden sleepers, resting on the parallel beams), masonry, soil, &c. Upon examining the beam as it lay in the river, I could perceive two fractures in it,—one of which, in the middle length, had to all appearance, been the result of the fall, and not anterior to it. The other, doubtless the immediate cause of this frightful accident, was from 17 to 20 ft. distant from the south pier of the bridge; and, as the engine-driver said he felt the giving way beneath him, allowing for the length of the tender, there can be no doubt that this was the fracture which caused the calamity. The fracture was directly across the beam, from its upper to its lower flange; and connected with this was another fracture, running in a line nearly parallel to the bottom flange for about 4 feet, and then curving across to the upper flange for a length of 4ft. more. This, however, might be caused by the fall, the flat side of the beam striking against the rock or other hard substance. The trusses or tension rods, so far as we could see them, appeared to be entire. Until this massive girder is got out of the water, which in part conceals it, it is impossible to say what may have been the cause of its fracture. So far as it could be seen, it did not appear to be from any flaw or defect in the metal. In one account I have seen, the accident, it is suggested, may have arisen either from the piers not being sufficiently consolidated, or the stone defective, or the iron bearings becoming warped by some heavy trains of iron from Ruabon passing over them, or from an unstable foundation. So far as I could judge, none of these appeared likely to be the real cause of the accident. The piers are quite firm and still standing; and just so much of the masonry has gone as the beam would be certain to drag downwards with it; and as to heavy trains of iron from Ruabon, I learn that there had been nothing of the kind—no wagon bringing more than 4 or 5 tons of iron. Indeed, the bridge was most severely tested before it was open to the public, by trains of ballast wagons passing over it,—probably 30 loaded wagons of 7 tons each, or 210 tons altogether over the whole structure. There is not the slightest appearance of the foundation having "settled" in such a manner as to endanger the structure, and it being only one beam that has given way just one-sixth part of the girders of the bridge—the inquiry seems considerably narrowed.

Mr. Lee, clerk of the works of the line, supposed that the girder was broken by a sudden blow at the side. The proceedings were adjourned for the attendance of General Pasley, who had certified the security of the works.—June 2. Mr. J. Walker, C. E., sent down by the Admiralty, Captain Simmons, the deputy-inspector of railways, and Major Foster, the inspector of fortifications, also attended on the part of Government. Major-Gen. Sir C. Pasley was present. Messrs. Locke, Vignolles, and Gooch, engineers, were in attendance to give evidence as to the solidity and construction of the bridges.—W. Clegg, W. Clark, and Mr. W. A. Rowland, who had painted the bridge in April last, noticed the deflection of the bridge between four and five inches, whilst a ballast train passed over it. N. Welman, stonemason, engaged in building the bridge. It was erected according to the plans and specifications. It was originally intended to have carried the bridge over five arches, but in consequence of the interference of the Tidal Commissioners, the works were for a time delayed, when those now erected were determined on. He had, since the erection, examined the masonry, and not discovered any settlement of the piers or abutments. He did not think the girders safe; they were not properly supported by the stanchion rods; but never told any one that it was unsafe. W. Watson, a contractor's agent, was desired on Monday to put some ballast on the railway bridge. He followed the 3h. 23m. down train, and commenced distributing the ballast. About 20 wagons of ballast were distributed. Did not observe the deflection of the girders while the train was on the bridge. The next train that came over was the 6h. 15m. passenger one, which met with the accident.

Major-Gen. Pasley said, I was the Government Inspector-General of Railways when the Chester and Holyhead was opened: I surveyed the bridge over the river Dee on the 20th of October, and reported it as safe; examined it in such detail as I deemed necessary. It is an iron girder bridge of three openings or spans of 98 ft. each; wrought iron tension rods are used to strengthen it. I always was of the opinion, and am so still, that these tension rods are not of great use, because I consider that the expansion of wrought and cast iron from heat differs in some degree, although not very greatly; but that iron girders being very massive and the tension bars thin and of small dimensions, the sun may act on the wrought iron rods very considerably and less on the cast iron girders, and, supposing them to be adjusted for a moderate temperature, the intensity of hot weather may destroy their proper proportion and do away with the benefit of the tension. I may here state that wrought iron when acted upon will elongate considerably without breaking. There have been a number of bridges of this description erected on railways in various parts of England, both before and after I held the appointment of Inspector-General of Railways, none of which, with the exception of this one, ever failed. They were not quite of the same extent, but I will allude to a cast iron girder bridge at York, over the river Ouse, of the York and Scarborough, which has two openings of 70 ft. span. The least depth of the iron girder on that bridge is 3 ft. The least depth of those on the Dee bridge is 3 ft. 9 in.; and as the bridge at York and other similar bridges have stood, I concluded that this one would, as it had an extra depth. I may also mention another bridge over the Tees at Stockton, although I have not seen it. I may vouch for what I state to be correct. It has a span of 83 ft. 4 in. and the least depth of iron is 3 ft.—Mr. R. Stephenson said it was 87 ft.—General Pasley: you may be correct. The flange on this bridge is greater than on others. I have frequently mentioned to engineers that wrought iron tension rods would do little good. In my inspection of a cast iron girder bridge, on the System of Peterborough, built by Mr. Liddle, I found that he had omitted tension bars, and in my Report to the Earl of Clarendon I approved of the omission, and considered it a preferable construction. It appeared that Mr. Liddle could not get the tension rods in time, and therefore he built the bridge without them. It has been stated that some time after the Shrewsbury and Chester was opened and after I had inspected it, a girder was cracked and replaced by a new girder. This circumstance, which I did not know, and which was never reported to Government, coupled with the fracture of this one, induces me to think that they are not safe, and that it is the mere cast of a die between their safety and danger. They are on the verge of danger. By examining the bridge on Thursday last and to-day, I consider that the tension rods are of very little use indeed. The tension rods are connected with the girder alone, as if they were part of it. They have no independent support, and there is a difference between this bridge and Mr. Stephenson's former iron girder bridges. In all his former iron girder bridges there is a connexion from girder to girder, on the central pier or piers, from one end of the bridge to the other, so that when the pressure is on one girder the other girder in the same line contributes to assist. That is the case with the one on the river Ouse at York. The horizontal portion of these bars appears to be useless. The oblique tension bars would be of use if the upper ends were fixed to some independent support to each pier, and similar independent support on each abutment, and if the standards or support over the abutments had tension bars extending inland to resist the heavy weight going over the extreme bays or openings of the bridge. There is a swing bridge over the river Wensham at Norwich, strengthened on this principle, and which is extremely judicious. In this case I consider that the girder broke on a train passing over, added to the weight of the ballast that had been thrown on it in the course of the morning. The masonry gave way from the girder breaking, and from that cause alone. I examined the girder, and the castings seemed very good, and I believe it is generally admitted that they are good, but the girder was too weak after the ballast that was put upon it. The girder was far enough in the masonry to support it. There was bearing enough to render it secure.—Coroner: Would the engine-driver suddenly putting on the steam, cause the engine to bound with such force as to break the girder?—Gen. Pasley; No, certainly not. I saw nothing to throw the engine off the rails on the bridge, which had strong guard rails. I should say that no girder could have withstood a deflection of 5½ in., as stated by a witness this day. I think that person is a very inaccurate observer. It would have broken short at once. A continued deflection of 4 in. must have broken it long before this occurred.—Sir E. S. Walker: If this bridge were restored to its original state, would you be prepared to pass it fit for public security?—Gen. Pasley: No, I would not, as I am not infallible. Although I did sanction its opening, I should not now allow trains to pass over it without fixing independent supporters. It could be rendered perfectly safe by adopting what I suggest. For my own part, and I am not troubled with nervousness, I certainly should not like to travel over it until it was secured as I have stated.—By Mr. Tyrrel: I do not believe that the tender ran against the outside girder. I noticed the masonry that was disturbed. I did not measure the height of the abutment; in reference to the tender I did not notice in particular that the chains were broken. I was told that one of the wheels of a carriage was broken, and I am only surprised that they were not all broken. In all the railway accidents that I have had to inquire about I never found a train precipitated into a river.—By Sir E. Walker: If the tender had struck the girder I should say that the stoker might have been thrown into the river. I noticed that the tender had struck something. The nature of the accident has proved to me that there was no defect in the flange, but brackets or girders would be a great improvement. Mr. Robert Stephenson, the engineer-in-chief of the Chester and Holyhead, being sworn, handed to the coroner the following Report on the accident which he had made to the directors:—

1. The masonry of the wing parapet on the Saltney side was much shattered and displaced, bearing evident marks of having received a violent side blow. 2. On examining the tender of the engine it was clear that it came violently in contact with the masonry, and caused the disturbance just alluded to. 3. All the lateral ties which bound

the girders together sideways, thirteen in number, each measuring 4 in. by 1 in. (giving a total area of 52 in.), were either torn from the sockets in which they were formerly fixed, or forcibly wrenched off near to the sockets of the girder left standing. 4. That portion of the broken girder which is now lying against the pier at a considerable angle, must have been drawn off the pier, and after the fractured end had reached the ground, the end which rested upon the pier must have fallen back upon the upright side with great force, as is shown by the deep indentation made in the masonry by the upper end of the girder, without any trace of violence between the top course of masonry and the indentation. 5. On examining the wrought iron work of the girder the whole was found sound, except one of the leaves of the internal wrought iron link, against which the tender or the carriages would necessarily strike on leaving the rails, which was severed about 18 ft. from the Saltney abutment, and near to the point where the first fracture of the girder itself took place. 6. On examining the broken girder itself, the fracture was precisely such as might be expected from a large piece of the vertical rib being broken out of the girder, and separated from the lower flange, which remains perfect; a description of fracture which could scarcely be produced by a vertical action.

After attentively reflecting upon these facts as indicative of the movement which took place during the accident, I can arrive at no other conclusion than that it arose from a violent side blow against the girder, near to the abutment on the Saltney side; that this was the first place of fracture; that the other fractures were consequent upon the fall. The tender of the engine had incontestibly left the rails before reaching the abutment, because it struck the very first portion of masonry and moved it laterally. The tender must have been considerably raised up, because the marks on the masonry are much higher above the level of the railway than those parts of the tender which have produced the effects when in their proper position. These two circumstances leave no doubt on my mind that the tender, and probably some portion of the train, were off the rails some distance before reaching the Saltney abutment. If we suppose the fracture to have taken place by vertical action, it is evident that this would give no tendency to side motion until the platform of the bridge assumed an angle in the direction of the broken girder: but the horizontal ties connecting the girders on opposite sides of the roadway would immediately come into action to prevent any side motion. They clearly did so, and their great strength and number is fully equal to the entire suspension of the platform and girder after fracture, consequently they would tend to draw the broken girder in its face underneath the firm girder, which was left standing. This tendency having been entirely counteracted is another proof that great lateral action had come into play. With this view of the subject, the question naturally arises, what would cause any portion of the train to leave the line? The entire demolition of the platform unfortunately prevents even a probable reply; yet there is a fact connected with the state of the wheels of the carriage as found in the river which seems to justify the suspicion that a wheel did break antecedent to the accident. All the wheels were found in a sound state except one, which was, I am informed, entirely destroyed, the rim and spokes being stripped from the boss. Now, the simple fall of a carriage, even with other carriages, is scarcely likely to cause such a destruction to a wheel ; on the other hand, any accident to a wheel in a train when in motion would cause such a separation of the rim and spokes from the boss. Whatever may have been the primary cause of the accident, I think it is most clear that a violent lateral blow was the immediate cause of the fracture of the girder. It has been urged by some that the existence of check rails throughout the whole length of the bridge precludes the possibility of any portion of the train having left the line. To those acquainted with railways practically, no argument need be adduced to controvert this opinion, since it is well known that, in any violent collision amongst the carriages of a train, check rails scarcely ever avail, as they are only calculated to counteract any moderate tendency to leave the rail, and are consequently very generally adopted on long viaducts.

In considering this accident some persons, whilst they acquiesce in the evidence tending unequivocally to establish a violent side action, endeavor to attribute it to the centrifugal force arising from the railway being on a curve throughout the length of the bridge. Now, there can be no doubt that such a condition of the rails gives rise to side pressure, and also on viaducts to some vibration ; but in the present case the radius of curvature is fully two miles, which would give for the centrifugal force, at a speed of 30 miles per hour, a lateral strain of 1-177th part of the weight of the train, which in the present instance would be about 750lb.—a pressure totally inadequate to produce any sensible effect. The curved direction of the line would doubtless occasion a little more vibration throughout the structure than if the line had been perfectly straight, and this, no doubt, might, by a remarkable occurrence of causes, occasion a little more than ordinary strain upon the bridge, but I cannot conceive such to have operated in the instance before us. Looking fairly at the fact that much heavier trains, moving at greater velocities than that to which the accident occurred, have been constantly running over the bridge since October last, without the slightest symptoms of failure, it appears to me unreasonable to attribute the accident to any combination of causes which one would say must have been daily repeated for some months past.

It has also been suggested that the unequal expansion and contraction of the girder during great changes of temperature might probably interfere with the uniform strength of the metal. It is impossible to deny that this circumstance does sometimes interfere with the strength of cast iron beams, but generally this influence may be regarded as confined to castings where the thickness of the different parts varies considerably. In the present case the form of the castings was carefully studied, and with only such small deviation from absolute uniformity in all the thicknesses of the different parts of the section as practice has long proved to be justifiable.

With regard to the competent strength of the structure, I concur generally in the deduction drawn by Mr. Yarrow, in which I am confirmed by an extensive experience in the construction and use of similar structures, tried under circumstances that demonstrate their capabilities to meet all the ordinary contingencies of railway traffic.

June 3.—Mr. Stephenson was examined, and especially with reference to Gen. Pasley's arguments. The following is an abstract of Mr. Stephenson's evidence, which we hope to be able to give hereafter in greater detail :—He (Mr. Stephenson) deeply felt the responsibility that was attached to him ; he knew that as yet the public mind was against him, but his opinion as to its solidity and construction was unaltered, and it would be confirmed ; not that it was upon a new principle, for it had been in use for years, but that it must be adopted sooner or later, for the benefit and security of the public. He then proceeded to detail a subsequent inspection he had made of the bridge with Mr. Locke and other eminent engineers. The platform being carried away, it was difficult to state the point at which the tender left the rails, but on examining the inner chair, there was an indentation as if something had bounded upon it, and it was evident that it had kept in strict contact with it all the way up, as the bolt had been scraped out. This no doubt, was the tender which had so bounded, for on viewing the stone-work of the abutment, they could trace, adhering to the face of it, some of the paint and wood of the tender. Then looking at the fracture in the girder, it certainly arose from a side blow, and not vertical pressure. Some of the chairs bore proof of something having passed over them, and from the circumstance of one of the wheels of a second-classs carriage being nearly destroyed, while the others were in a sound state, it is to be inferred that it met with considerable obstacles. What was the primary cause of the accident he was unable to state, but it was clear that a lateral blow, was the immediate cause of the fracture of the girder. During an experience of 20 years in building railway bridges, this was the first failure he had ever encountered.—Sir E. Walker inquired of him if he intended to make any alteration in the construction of the bridge.—Mr. Stephenson replied, that he proposed to make certain alterations with a view of appeasing the public mind.—Sir. E. Walker hoped he (Mr. Stephenson) would succeed in getting the public over it. All he could say was that he would not travel on it. —Mr. Stephenson trusted he would again obtain the public confidence.—Clayton, the engine-driver, was re-called, and on being asked if he saw any part of the train off the line when he felt the sinking, he replied that he did not look behind him, he was so alarmed.—Mr. Locke, engineer of the Grand Junction line, corroborated Mr. Stephenson's testimony ; he said the bridge did not fall from any pressure downwards, but from a side blow ; this, the examination of the fragments proved to him ; he considered all manner of iron bridges objectionable when brick and stone bridges could be had, as was the case, cheaper and better. "Mr. Coroner and gentlemen of the jury," said Mr. Locke, "I believe that much blame lies at the doors of the Commissioners of the Admiralty, the Board of Trade, and the Commissioners of Railways, who require bridges built with too large a span, to answer their views as to shipping and other matters, without at all consulting the interest or safety of the public. I wish this to go forth to the world. I wrote a letter to Government on the subject, and am sorry to say it was not attended to."

If the evidence of the witnesses, Clegg, Clark, and Rowland, is trustworthy, no doubt can exist as to the insufficient strength of the girders. We cannot understand though, how it is possible that so great a deflection as five inches, could take place without the direct fracture of the girder. Judging from the best information we have upon the point, it would appear that Mr. Stephenson's conclusion as to the ultimate cause of failure is the likeliest of any. Nevertheless we must say that we have no great faith in cast iron when employed for such large spans as the present one. Gen. Pasley's evidence has given us a little surprise, and we confess that it is a difficult matter to make out his meaning. After stating that he reported the bridge as safe, he says that he afterwards learned that one of the girders had cracked, and been replaced by a sound one, and he now thinks of "this kind of bridge, that they are on the verge of danger." If the length of span, as it undoubtedly must be, is objected to, then the Admiralty must bear the brunt of the matter, as they only permitted the engineer to have three arches, when he wanted five, and the girder form was adopted to give them the required amount of head-room.* However, if the Inspector-General of Railways felt sufficient confidence in the bridge, to pass it as safe for traffic, why does he turn round upon hearing of the cracking of a girder, and tell us that he has no faith in them?

It is not very long since a bridge fell down on the very day that the Inspecting Engineer presented his report upon its trustworthiness. We shall shortly begin to doubt the infallibility of even a Government Inspector.

Ibid.

Railway Profits

The principal railway companies in the United Kingdom, having lines completed and at work, are 28 in number; the length of their lines in operation is 2418¾ miles, and the total cost, to the dates of the last balance sheets, is £77,162,952. The dividends now paid upon the different items of which this capital is made up, vary from 2 to 10 per cent., in the following proportions:—

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* We have since heard that the Admiralty did not interfere, but that the engineer changed his plan from five arches to three, in order to get over the difficulties of the bad foundation for the supports.

On £1,079,867 the dividend is	£2	0	per cent.
On 853,918	2	8	"
On 520,341	2	12	"
On 142,900	3	0	"
On 4,741,249	3	10	"
On 1,174,969	4	0	"
On 5,705,057	5	0	"
On 1,085,498	5	10	"
On 2,005,127	6	0	"
On 26,276,102	7	0	"
On 8,426,000	8	0	"
On 2,062,053	9	0	"
On 23,089,571	10	0	"
£77,162,952			

The total dividend upon the various items above enumerated, amounts to £5,746,068 per annum, being an average of 7½ per cent., within a fraction, on the entire sum invested by the shareholders in these undertakings. It should be borne in mind, too, that the resources of many of these companies are, as yet, but imperfectly developed. In some cases the lines are but partially opened, and in others, such as the Great Western, though the main lines are complete, many of the tributaries essential to the full development of the system of which they form part, and from which much increased wealth and prosperity must necessarily flow, are, as yet, incomplete, and have brought nothing to the general fund. Lond. Min. Jour.

AMERICAN PATENTS.

List of American Patents which issued in the month of July, 1846,—*with Exemplifications, by* Charles M. Keller, *Agent for procuring Patents, and late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improved Level for determining angles;* Augustus Girard, Mobile, Alabama, July 2.

This instrument consists of a straight edge, to one end of which is jointed the case of a spirit level. The straight edge is furnished with a graduated quadrant, to determine the angle which the spirit level shall make with the straight edge.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the rod, the movable piece furnished with a spirit level, and the graduated quadrant, as herein set forth."

2. For an *Improvement in the Piano Action;* Luther Philleo, Utica, New York, July 2.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is placing a roller in the upper end of the jack, and its general application to the action of the piano forte, as herein above described, by which means I am able to produce the following important results, viz:—

"First. The greater power obtained in the stroke of the hammer.

"Second. Its greater velocity.

"Third. A greater distance is passed by the hammer, in its stroke, with the same given movements of the key.

"Fourth. The certainty of the roller holding on until the proper time to release."

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3. For *Improvements in the Machine for Cutting the Nicks in the Heads of Wood Screws;* Thomas W. Harvey, New York City, July 2.

The claim in this patent refers to, is wholly dependant upon, and could not be understood without reference to, the drawing, we therefore omit it; but it is our intention to give an account of this, in connexion with other machines, patented subsequently by the same person, for the manufacture of wood screws, that the whole series may be together.

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4. For an *Improvement in the Cooking Stove;* George M. Norton, Rochester, New York, July 2.

The patentee says,—"The nature of my invention consists in an oven, so constructed as to bake perfectly even and uniform on all sides, by means of an air chamber, so constructed as to distribute the heat produced between the plates of the oven top, and the fire plate, and the front oven side, into the ends of the oven, or between the plates of the oven doors. Also, the mode of conveying the steam, produced by baking meats, or any other article producing steam, by a draught into the back flue from the oven.

"The nature of my invention also consists in the construction and application of a damper for admitting, by a draught, a great quantity of cold air, to protect the plates most exposed to the fire from burning out; and also, to regulate the heat of the oven when baking. The nature of my invention also consists in the construction of the main bottom plate of the stove, thereby avoiding the difficulty of casting separate, and keeping in its place, a flue plate, which is liable to warp and spring by exposure to heat."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode of producing the draught through the air chamber into the back flue, as herein described.

"I also claim the mode of conveying the steam, produced by baking, from the oven into the back flue, as herein described."

5. For an *Improvement in the Process of Preparing Tannin, for Tanning Leather;* Wm. Germar, Easton, Pennsylvania, July 2.

The patentee says,—"The nature of my invention consists in fermenting the bark, by which process the tannin contained in the bark is fully extracted, and so dissolved, that it enters into a chemical connexion with the fibres of the hide, without becoming crystalized."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the preparation of a bark-liquor, by a process of fermentation, as herein described, to be applied to the purposes of tanning leather; using for the purpose of preparing the liquor, a ferment, and any alkali, neutral salts, or other material, that will produce the desired effect."

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6. For an *Improved Process for the Bleaching of Rags, &c., in the Manufacture of Paper;* Joseph G. & Jonas H. Kendall, of Worcester and Leominster, Massachusetts, July 2.

Claim.—"The subscribers do not claim as their invention or improvement, the use of the said acid, nor of the chloride of lime, nor of the chests or drainers, all which are well known and much used; but they claim, as a new and valuable improvement in bleaching papermakers' stock, as rags, &c., the above described method, process, or mode of bleaching, and of applying said bleaching substances to, and upon, large masses of stock, as rags, waste, bagging, and other materials, made into paper, lying, drained of water, in chests or drainers, as set forth in this specification."

The above method or process is pointed out by the patentees, in the following extract from their specification, viz:—"The improvement for which a patent is sought, consists in the application of well known bleaching substances to the material used in making paper, as cotton, linen, hemp, &c., after the same has been washed in the engines of a paper mill, and is discharged into chests or drainers; or, in other words, the improvement consists in the process or mode of application of such bleaching substances, in such chests or drainers."

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7. For an *Improvement in the Lard Lamp;* John Davidson, Baltimore, Maryland, July 2.

The nature of this invention consists in striking out of one piece of sheet metal, the glass holder, and supporter of the deflector, and outer tube, the said piece acting as a cap over the top of the reservoir, to which it closely fits, and on which it rests.

Claim.—"Having thus fully described my improvement in lamps, what I claim therein as new, and desire to secure by letters patent, is connecting the tube and shade holder, by means of a cap, which covers the top of the reservoir, in the manner described, (the whole being made in one piece,) by which a great economy is effected in the construction, and the burning of the lamp greatly improved."

8. For an *Improvement in the Method of Increasing the Adhesiveness of the Surface of Pulleys, Drums, &c.;* John Simpson, Decatur, Georgia, July 7.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the giving the face or periphery of drums, pulleys, &c., upon which bands are used, a coating of India rubber, or some other gum covering of a similar nature, for the purpose herein set forth."

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9. For an *Improvement in Lifting, Suction, and Force Pumps;* Chapman Warner, Louisville, Kentucky, July 7.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of connecting the air chamber with the plunger, emptying the water from the holes, so that the air chamber and plunger will be elevated and depressed together."

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10. For an *Improvement in the Shank for the Knobs of Doors;* L. R. Livingston, J. J. Roggen & Calvin Adams, Pittsburg, Pennsylvania, July 7.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the method of making the shank for door knobs in two pieces, coupled together, near the middle, by a notched connexion, and held together by means of the escutcheon at one end, and to the latch-tumblers or follower at the other, as herein described."

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11. For *Improvements in Lamps;* T. F. Strong, a citizen of the United States, residing in London, England, July 7, 1846, antedated May 1, 1846.

The patentee says,—"The nature of my invention consists in so conducting the air to the flame, as to have it lightly heated before it impinges on the flame, without the use of the button, and in such a manner as to prevent its flaring; and also, in the mode of raising and lowering the wick, without revolving it, by means of an upright screw, that works into a nut on the bucket or thimble."

Claim.—"Having thus fully described my improvement, what I claim therein as new, and desire to secure by letters patent, is constructing the reservoir in the manner described, so as to prevent the oil from leaking out over the cover, while a flat broad receiver is retained, as herein set forth.

"I also claim the raising and lowering of the thimble or wick-holder, by means of the screw, constructed, arranged, and combined, as herein set forth.

"I claim the cup or sunken chamber, for heating or supplying air to the outside of the flame of an argand lamp, as specified.

"I also claim constructing the deflector with holes around and below its upper edge, in the manner and for the purpose described.

"I also claim the lamp chimney, formed of glass, with two contractions, substantially as above made known."

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12. For an *Improvement in the Furnace for Heating Buildings;* John Barker, Baltimore, Maryland, July 7.

The patentee says,—"My air heating furnace is to be enclosed in a chamber of masonry, in the ordinary manner of placing such furnaces; and the air that is heated therein, is to be conveyed through suitable tubes, to the apartments to be heated, as usual. But I have so arranged the pipes which conduct the heated air from the furnace to the chimney, as that the cold air which is admitted from without, and which is to be heated by said pipes, shall be forced into immediate contact with them, by causing it to pass up within channels formed in the brick work, which is made nearly to enclose said pipes. Of these air heating pipes, I employ a single tier only on each side of the heating chamber, and that as near to the floor as they can be placed with convenience, and nearly surrounding its four sides."

Claim.—"Having thus fully described the manner in which I construct and arrange the respective parts of my air heating furnace, what I claim therein as new, and desire to secure by letters patent, is the particular manner in which I have arranged the air heating pipes, enclosed in spaces formed of masonry on each of their sides, and extended partly over them, with an opening at top for the passage of the heated air; said pipes forming a single tier within a few inches of the bottom of the air chamber; the whole construction and operation being substantially the same with that herein set forth."

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13. For *Improvements in the Boot and Shoe Tree;* Jonathan Russell, Philadelphia, Pennsylvania, July 7.

The tree, either for boots or shoes, is made of metal, hollow, with the sole piece hinged, so that, by means of a forked lever inside, that turns on a fulcrum, with the forked ends provided with adjusting screws, and the rear end acted on by a screw that runs up above the top, the sole piece can be forced down to stretch the foot. Within the leg of the tree there is a lever, jointed near the bottom, and connected with a horizontal screw at top, and provided with a projection near the lower end, so that the lever end of the back piece can be forced out, to stretch the boot across the small and heel measures.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the constructing boot and shoe trees of hollow metal or wood, in combination with the forked lever, vibrating sole piece, and screws, (either with button heads or cap pieces,) combined and operating with the screw, for stretching a boot or shoe, substantially in the manner and for the purpose herein set forth.

"I also claim the combination of the screw, lever, and projection on the same, with the back piece and key of the leg of the boot tree, for stretching a boot across the small and heel measures, substantially as herein set forth."

14. For *Improvements in the Machine for Cleaning Grain;* Wm. H. Stevens, Salem, Illinois, July 7.

Claim.—"Having thus fully described my fan, what I claim therein as new, and desire to secure by letters patent, is, first, the return blast, or combination of the fan and spout, by which the blast from the fan is made to sweep around a curve through the grain in passing to the screen, substantially in the manner and for the purpose set forth.—Secondly, I claim the combination of the revolving screen with the fan, in the manner described, so that the grain shall pass to the screen after it has passed the blast from the fan, as described. Thirdly, I claim in the construction of the screen, made by winding on a continuous wire, in parallel lines, with spaces between, the method of tightening the same, by means of the outside ribs and iron bands, so as to preserve the proper distance between the wires, as above made known."

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15. For *Improvements in the Hot Water Furnace, for Warming Buildings;* Ezra L. Miller, Brooklyn, New York, July 7.

The patentee points out his two improvements in the following terms, viz:—"The first of these, which I denominate a condensing radiator, consists in a new and improved arrangement, combination, and application of the different parts and surfaces of a hot water apparatus, or furnace for warming buildings, by which the circulation of the water, in contact with the radiating surfaces, is much accelerated, and the air for taking off the heat is, in its circulation, brought and kept more closely in contact with the water-heated surfaces, than by any former method. My other improvement, which I denominate a hydro-pneumatic regulator, consists in the peculiar application of the expansibility of water and air, combined, to produce motion in a damper or dampers, for the purpose of regulating the degree of combustion in a furnace."

Claim.—"I do not claim as my invention, the simple use or application of a cylindrical or other shaped vessel, filled with tubes, for the purpose of radiating heat; but what I do claim, and wish to secure by letters patent, is the combination of the condensing radiator with the hydro-pneumatic regulator, and a boiler or boilers within a hot air or furnace chamber, as herein fully described and set forth; whether the condensing radiator be cylindrical or other shaped, if so constructed and combined as to be similar in principle and effect.

"I also claim the peculiar manner of applying the expansibility of water and air, combined, to the working of a damper or dampers, for the regulation and control of the combustion of the fuel in a furnace, in combination with a condensing radiator, as herein fully described and set forth."

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16. For an *Improvement in the Furnace of Steam Boilers, Stoves, &c., for Burning Anthracite Coal;* Ezra L. Miller, Brooklyn, New York, July 7.

The patentee says,—"My improvement, which I designate a boiler furnace, consists in making a new arrangement of the furnace or burner, for producing the most active combustion of the fuel, at or near the base of the fuel, and so near the grate bars, as always to insure the necessary supply of air to effect a perfect combustion; the combustible portion of the smoke and gases, liberated from the fuel, being consumed by passing through the most intense heat of the fire, in their escape from the burner, and by combining with this arrangement, a reservoir or chamber for fuel, above the line of draught, of sufficient capacity to contain fuel for any desirable length of time, which, as the combustion proceeds, settles into the base of the burner, and thus becomes self-feeding, until the fuel is consumed."

Claim.—"What I claim as my improvement, and wish to secure by letters patent, is the peculiar manner, as fully described and set forth in the above specification, of constructing the base of the fuel chamber with an off-set or enlargement, so as to admit of taking out the smoke flues or tubes through it, or near a vertical direction at the top of the burner, and around the circumference of the fuel chamber, and, by these means, adapting it to a furnace for boilers, as well as to stoves and hot air furnaces."

17. For an *Improvement in the Jack, or Jack Screw;* Wm. Ballard, City of New York, July 7.

The claws project from the lower end of a screw, and at right angles thereto, and are fitted to side bars, that form sliding ways for them; on the screw there is a nut, with bevel cogs, that engage in the cogs of a bevel wheel, on a crank shaft. The whole is arranged within a case, in the usual manner. The side bars not only steady the jaws, but, at the same time, prevent the screw from being turned by the nut.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the claw-screw, rod, and slide bars, as above described, and for the purpose herein set forth."

18. For a *Machine for Cleaning Buckwheat;* Daniel Pease, Jr., Floyd, Oneida County, New York, July 14.

This machine consists of a horizontal cylinder, within a concave. The surface of the cylinder is provided with wedge-formed rubbers, with plates between them, and at the end there is a section of a many-threaded screw, the concave being made to correspond to the cylinder, for the purpose of forcing the grain in and through, between the concave and cylinder, the concave being armed with flutes, teeth, &c., to make friction.

Claim.—"That which I claim as my invention, and desire to secure by letters patent, is—

"1st. The section screw, to drive the grain lengthwise the cylinder, in combination with the wedge-like rubbers.

"2d. The manner of setting the wedges on the revolving cylinder, to give friction to the grain.

"3d. The screw formed in the outside cylinder, to force the grain lengthwise of it, in combination with the wedge-like rubbers.

"4th. The arrangement of a slide to regulate the pressure of the grain in the cylinder."

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19. For an *Improvement in the Water Wheel, called the "Double Centre Vent Water Wheel;"* Wm. March, Sandbank, New York, July 14.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the peculiar form or curve which I give to my buckets, as herein described and represented; the outer end or lip thereof being curved inwards, or towards the centre of the wheel, the middle portion having the form of a very flat ogee, and the inner end being straight, and tangential to the inner circumference of the ring of the wheel."

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20. For *Improvements in the Safe Lock;* W. E. Woodbridge, New York, July 14.

Claim.—"What I claim, and wish to secure by letters patent, is—

"First. The interposing of a set of tumblers, substantially as herein described, between ordinary check tumblers and the key, in such a manner that, when acted on by the key, they shall raise their corresponding check tumblers to their proper height, and having tongues so related to a stump, attached to the lower side of the bolt, that they, (the interposed tumblers,) must descend after the full action of the key upon them, in order to allow either the bolt to pass, or the upper stump of the bolt to touch the tongues of the check tumblers, which arrangement also prevents the motion of the interposed tumblers, when, in an attempt to pick the lock, the upper stump is in contact with the tongues of the check tumblers.

"Second. The down tumblers, arranged with reference to the tumblers, so as to dispense with the use of springs, or other parts, to return the check tumblers to their original position, after projecting the bolt either outwards or inwards."

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21. For an *Improvement in the Chimney Cap;* William S. Burch, Washington, D. C., July 14.

The patentee says,—"The great difficulty heretofore experienced in the construction of chimney caps, has been to prevent smoking, in any state of the atmosphere. Several caps have been found efficacious in windy weather, but are worse than nothing, if applied to the top of the chimney in a calm, and, at such times, actually impede the draught. Others, again, may answer in certain states of the weather, but not in others. By my improvement, I can cure the worst case of smoky chimneys, and in all states of the weather."

Claim.—"Having thus fully desciibed my improved cap and its mode of operation, I wish it to be understood that I do not claim as new, the application of conical caps to the tops of chimneys in many different ways; but what I do claim as my invention, and desire to secure by letters patent, is the combination of the inclined conical tube with the revolving chimney cap, substantially in the manner and for the purpose herein set forth."

22. For an *Improved Mode of Teaching Children the Fundamental Rules of Arithmetic, by means of Tables arranged on Rollers, called the "Rotary Multiplication, Addition, and Subtraction Tables;"* Benj. M. Vanderveer, Clyde, New York, July 14.

Claim.—"What I claim as my invention, is the form of these tables, and the operation of bringing together the figures or numbers to be multiplied, added, or subtracted, and the novel manner of showing, not only the particular product, but a series of different products, at one and the same time, through the holes, giving the pupil the advantage of eleven results before his eyes, without confusion or distraction; and, in the language of an eminent teacher who has examined the tables, 'relieving the young learner from the tedium and irksomeness with which the knowledge of the combination of simple numbers has been heretofore burdened.'"

23. For an *Improvement in the Fastenings for Window Blinds and Shutters;* Samuel Lichtenthaeler, Litiz, Pennsylvania, July 14.

On the hinged edge of the shutter there is a plate, provided with cogs, that engage with the cogs of a wheel, on the end of a spindle, that passes through the window frame to the inside of the house, so that, by turning the spindle, the shutter is closed or opened; and on the spindle there is a helical spring, which forces a bolt into a notch in the plate, at the appropriate time for fastening or holding the shutter in the required position.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the principle of opening and shutting, and holding firmly in any desired position, from the inside of the room, outside window shutters, or blinds, by the before described combination of the shaft, cogged wheel, spring, and cogged plate, constructed, arranged, and operated in the manner and for the purpose set forth."

24. For an *Improvement in the Mode of Manufacturing Wrought Iron Nails, for Horse Shoes:* Jedediah Holcomb, Brandon, Vermont, July 14.

We are under the necessity of omitting the claims, as they refer to, and could not be understood without, the drawings.

25. For an *Improvement in Locks for Doors, Safes, &c.;* David M. Smith, Springfield, Vermont, July 14.

To the upper surface or edge of the tumbler, of the usual construction, there is a bar that may slide vertically, on two screws that project vertically from the tumbler; and above the spring bar, are arranged a series of cams, each on a separate arber, so that, when so turned that their lesser diameter is towards the spring bar, the tumbler can be lifted to open or close the bolt, but when they are turned in any other position, the bar prevents the tumbler from being lifted up to free the bolt.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the spring bar with the cams, &c., and spring lever; the whole being applied to the main bolt, and made to operate together substantially as above specified."

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26. For *an Improvement in the Threshing Machine;* Jesse Fitzgerald, New York, July 14.

We omit the claim in this instance, as it could not be understood without the drawings to which it makes reference.

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27. For an *Improvement in the Hot Air Stove;* Eleazer D. Loveland, City of New York, July 14.

This hot air furnace consists of six concentric cylinders with the fire chamber at the bottom, and in the second from the outside, the lower end of the four inner ones being above the fire. The products of combustion pass up from the fireplace between the second and third cylinders, (counting from the outside,) down between the fourth and fifth, and up to the chimney through the sixth or inner one, while the air to be heated enters at the bottom between the outer and the second cylinders, down between the third and fourth, and up between the fifth and sixth to a drum, from which it is to be conducted to the apartments to be heated.

Claim.—"Now, I do not claim, in the foregoing description of my improvement in hot air stoves, having any originality in the arrangement of the fire plate under the hot air flues, nor the damper for governing the direct draught, they being of common use in most hot air stoves: but what I do claim, and wish to secure by letters patent, is the manner herein described of combining the six cylinders and flue spaces, by which a greater extent of heating surface, for the purpose herein set forth, is obtained.

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28. For *Improvements in Machinery for Spinning Hemp;* John McCully, Salem, Massachusets, July 14.

Instead of giving a traverse motion to the bobbin or flyer to distribute the thread on the bobbin, there is an annulus or ring for guiding the thread that slides on the arms of the flyer, and receives its motion by means of a vibrating carriage provided with guide rollers in which the periphery of the annulus runs. The spindle of the bobbin is provided with a double friction pulley, so that, by means of a lever and regulating screw, the friction can be increased or diminished at pleasure to regulate the twist of the yarn, and as the motion of the annulus in one direction produces a drag on the yarn and not in the other, which would result in producing an uneven thread, this is obviated by connecting the lever of the friction pulley with another lever that is acted upon by a semi-circular cam, so that during one-half of the operation the friction pulley retards the motion of the bobbin.

Claim.—"Having thus fully set forth my invention, that which I claim is the annulus, in combination with the flyer and carriage beneath it, the whole being constructed and operating substantially in the manner and for the purpose as described.

"I also claim the combination of the fixed and rotary friction disks and lever, and its regulating screw, as the same is applied to the bobbin spindle and frame, and made to operate substantially as specified.

"I also claim the lever, and semi-circle or cam, in combination with the lever of the disk, the same being for the purpose as described."

29 For an *Improvement in Lamps;* Theodore F. Strong, City of New York, July 20.

The patentee says,—"The nature of my invention consists in taking an ordinary glass night lamp, when in the process of making at the glass blower's, and depressing the top, where the wick tubes are inserted, downwards, in such a manner as to elevate the sides some one or more inches above the top of the wick tubes when inserted."

Claim.—"In the construction of this lamp I do not claim the invention of any new material of which the lamp is made, nor the mode of using the socket and wick tube by inserting it into a cup of oil; but what I do claim as my invention, and wish to secure by letters patent, is the peculiar form which I give to the lamp cup: that is, by depressing the top of the lamp cup where the wick tubes are inserted downwards in such a manner as to elevate the sides of the cup some one or more inches above the top of the wick tube, and thereby surrounding the flame of the lamp with a transparent shield; for, when a lamp cup is depressed in the centre in this manner, it forms a hollow rim around the sides and top of the lamp, which is intended as a protection against the numerous accidents occurring everyday by oversetting of lamps and spilling the oil, or setting on fire articles coming into contact with it when overset. In this lamp, instead of the oil, when overset, running out at the vent holes, or the top, (or the socket, should it fall out,) the oil runs into the sides, which, being large enough to hold all the oil, prevents any spilling, and at the same time surrounds the flame."

30. For *Improvements in the Combination Lock;* John L. Whetstone, Cincinnati, Ohio, July 20.

The patentee says,—"In my combination lock I adopt the well known principle of permutation, there being any desired number of movable bits to the key which are to act upon a corresponding number of tumblers, which slide up and down vertically within the lock. A principal improvement in my manner of constructing the safety lock consists in my managing and combining the tumblers and the bits of the key, so that the tumblers may either be raised or drawn down, or in part raised or in part drawn down by the action of said bits.

The box of my lock I divide into two separate chambers by inserting a partition plate of the same width and length with the cap plate, midway between the cap plate and the face plate of the box, thus forming what may be denominated the anterior and posterior chambers. When the key is inserted for the purpose of moving the bolt, it is passed first into the anterior chamber, and is then turned partially around until it arrives at a proper opening through the division plate, where it is made to enter the posterior chamber and to operate on the bolt.

Claim.—"Having thus fully described the manner in which I construct my lock, and shown the operation thereof, what I claim therein as new, and desire to secure by letters patent, is, first, the manner in which I have arranged and combined the tumblers and the key, so as to allow the tumblers to be moved either up or down, by reversing them upon the racking stump, and by causing the bits of the key to act upon the upper and lower curve of said tumblers, substantially as herein set forth.

"I also claim the manner in which I have arranged and combined the revolving escutcheon and the bridge plate, the box of the escutcheon being adapted to the arm of the key, and to the bridge plate, in such manner as that, by the aid of the slot or opening, in said box, the arm of the key is allowed to pass between the bridge plate and the division plate, for the purpose and in the manner set forth."

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31. For an *Improvement in the Door or Gate Spring;* Jacob Shaw, Jr., Heinckley, Ohio, July 20.

This improvement consists in connecting by means of a joint link one wing of a common butt hinge with a spring attached to another wing made of greater length than usual.

Claim.—"I do not claim, *generally*, attaching a spring to a door or hinge in such a manner as to perform the double office of closing the door and forcing it open, according to the position of the door, this having already been done; but what I do claim is the particular manner in which I have arranged the spring or weighted lever, in combination with the door or hinge, for the accomplishment of that object."

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32. For an *Improvement in the Carding Engine;* M. W. Obenchain, Springfield, Ohio, July 20.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of the additional doffing roller between the two main carding cylinders, for the purpose of taking the fibres from the first main carding cylinder and transferring them to the second, with more regularity than heretofore, as described; and in combination with this, I also claim the stripper which works between the two doffers, and which transfers the fibres from them to the second main carding cylinder, as described. And, finally, I claim the employment of two roll-doffers, with longitudinal fillet cards, arranged substantially as herein described, whereby a much greater number of rolls can be made in the same space of time, and of better quality, than with the single doffer, in consequence of the regular action on the carding cylinder."

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33. For an *Improvement in the Machine for making Hat Bodies;* Russel Wildman, Hartford, Connecticut, July 20.

The patentee says,—" My arrangement consists in feeding the stock of fur, wool, &c., after it is properly prepared upon a common feed apron, in sufficient quantity to form a hat body of the desired heft, and thus feeding it through rollers which hold it firm, yielding it in small proportions to the rotary picker cylinder. The stock is thrown by the picker through the case divided longitudinally by two adjustable partitions on to a metallic perforated cone, placed near and in front of the tubes beneath the picker, as an aperture for the admission of a current of air to aid in carrying the stock through the tubes. The cone rests upon a revolving stand and thereby has a revolving motion whilst the body is forming thereon. Through the centre of the revolving stand is an opening connecting the inner surface of the cone with a trunk that is connected to a fan-blower by which the air within the cone is partially rarified causing a rush of air from all directions to and through the apertures of the cone, carrying the stock on to and holding it thereon in order to lay the stock in the desired proportion upon the cone, the tubes through which the stock is conducted, vary in height. The tube designed to form the brim spreads the stock from the base of the cone as high as the band of the hat. The second from the base of the cone to the square of the hat, a third from the base to the tip of the cone; an extra square is formed to the body by enlarging the second tube a little at top.

Claim.—" What I claim to be new and my invention in the above described machine, and desire to secure by letters patent of the United States, is the tube, (which conducts the stock to the cone,) divided longitudinally by adjustable partitions, for the purpose and in the manner substantially as herein described."

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34. For an *Improvement in the Carpet Loom;* William Sherwood, Ridgefield, Connecticut, July 20.

The claims refer throughout to the drawings, and could not be understood without them; and therefore we are under the necessity of omitting them.

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35. For an *Improvement in the Shifting Cam Loom;* Richard Garsed, Frankford, Pennsylvania, July 20.

The patentee says,—" In the weaving of twilled fabrics it is known that the sets of harness have to be shifted in succession whether consisting of three or more, commencing with the first, then the second, then the third, &c., and back again to the first: this has generally been done by a series of cams, one for each treadle, requiring the cam shaft to move very slowly and rendering an additional cam shaft necessary either for the harness cams or the shuttle cams. To obviate this I make the harness cams to slide endwise on the shaft, and provide them each with a cylindrical hub, the periphery of which has as many grooves cut in it as there are treadles to be worked by it in succession, these grooves run in the direction of the circumference nearly the whole circuit, but towards the end the first takes a diagonal direction and runs into the second, and in like manner the second into the third, and the third then crosses the second and runs into the first; the inclination of the grooves uniting the third and first and crossing the second, being greater than that which unites the first and second, and the second and third. These grooves receive a feather which turns on a stud pin projecting from the frame, so that as the cam shaft rotates, (supposing the feather to be in the first groove), the first groove runs on the feather, and when it becomes diagonal, to run into the second, the feather turns on the stud and runs into the second groove, thereby shifting the cam to the second treadle. In like manner it is shifted to the third, and then back to the first, the ends of the turning feather being rounded to prevent catching on the fillets between the grooves where the third groove crosses the second to run into the first."

Claim.—"I do not claim as my invention, simply giving a reciprocating motion, by means of a grooved cylinder, as that has been frequently done in mechanics; but what I do claim as my invention, and desire to secure by letters patent, is shifting the cams of looms by means of three or more grooves, running back into the first, and crossing the others, while the cams do not touch the treadles, in manner and for the purpose substantially as herein described."

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36. For an *Improvement in Locks for Carriage Doors, &c.;* James Ives, Hampden, Connecticut, July 28.

The patentee says that his invention consists—"First, in casting the lock case in one piece, with the exception of one of the side plates; second, in making the bolt with a journal on one face only; third, in securing the spindle of the handle in its place, by making it with a projection on the inner end, which, after passing through a groove in the bolt, and a corresponding one in the lock plate, on that face of the bolt which has no journal, and then turning the spindle partly around, is retained by the lock plate; and, fourth, making this last mentioned plate with cam-like projections, and providing the spindle with a spiral spring, the tension of which draws the projection on the inner end of the spindle towards the plate, and causes the spindle and bolt to turn around in either direction, from the highest part of the said cam-like projection, on which the projection slides."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is making the spindle with a projection on the inner end, that bears on the outer face of the lock plate, when this is combined with a bolt made without a journal on one face, or with a journal that does not pass entirely through the lock plate, or is of less diameter than the projection on the spindle, as described; and this I also claim, in combination with the cam or cams on the face of the plate, whether one or two journals be used, substantially as herein described, whereby a spring acting on the bolt is entirely dispensed with, as described."

37. For an *Improvement in Constructing Cisterns for Water;* Jacob Peebles, Concordia, Louisiana, July 20.

Claim.—"Having thus fully described the nature and object of my improvement in the manner of constructing cisterns in alluvial or wet soil, what I claim therein as new, and desire to secure by letters patent, is the combining of the conical form of the sides thereof, with the inverted dome bottom, in the manner and for the purpose herein fully made known. I do not claim either the conical sides or the inverted dome bottom alone, their combined action being necessary to the attainment of the end desired, and it will be manifest that, in making this claim, it is not a claim to a mere change of form, but to one that is necessary to the attainment of an important and very useful result."

38. For an *Improvement in the Wheat Fan;* Jacob Shermer, New Valley, Maryland, July 20.

We omit the claim in this instance, because of its dependence on the drawings, but it is simply limited to a method of arranging parts for combining the rock shaft and the shoe.

39. For an *Improvement in the Machine for Doubling, Twisting, and Reeling Yarn;* George Levan, Gap, Pennsylvania, July 20.

The patentee says,—"In the machines heretofore employed for this purpose, the single yarns are taken either from bobbins or reels, and two, three, or more threads passed through a flyer, which twists and winds them on to a bobbin, and then, by a second operation, reeled to form skeins. The object of my improvement is to perform the three operations of doubling, twisting, and reeling, all at once, which I effect, by taking as many bobbins as there are to be single threads in the compound thread, and placing them on pins in a disc, attached to a spindle, and at equal distances around the centre thereof, and passing all the threads through an eye at the upper end of the spindle, the rotation of which twists them all into one thread, which passes over guides, to a reel, to be wound into skeins."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the shipping of the apparatus, in combination with the reel, for the purpose of throwing the machinery out of gear, when the skeins are of the proper size, as described."

40. For an *Improvement in the Mode of Making Fences;* Joseph Stevens, Northumberland, New York, July 20.

Claim.—"Having thus fully described my improvement, what I claim therein as new, and desire to secure by letters patent, is the mode of combining the wooden panels with the posts, (constructed of clay or other suitable material,) substantially as herein set forth, so that the rails shall be permanently secured to, and suspended on, the posts, (which are placed diagonally in the fence,) by the top rails, that rest upon, and are affixed to, caps on the tops of the posts; the bottom rails being notched out at their ends, so as to embrace the posts, and the two rails being connected by the upright palings, as herein described, and for the purposes enumerated."

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41. For an *Improvement in Pencil Cases;* James Boss, Philadelphia, Pennsylvania, July 20.

The following claim will enable the reader to understand this improvement as clearly as we could describe it without drawings.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application to the pencil, (now in use,) of the combination described, to wit: the elongation of the cylinder, the increased length of screw, and particularly the box, to contain the leads, which will allow them to come out only one at a time, through the point alone, and that by so slight an exertion, as to be styled 'a self-feeding ever-pointed lead pencil;' and I do hereby disclaim the former invention, now in use in the common lead pencils."

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42. For an *Improvement in the Steering Wheel;* R. C. Holmes & J. J. Springer, Cape May, New Jersey, July 20.

The patentees say,—"The nature of our invention consists in the employment of two grooved rollers, mounted in appropriate bearings, one above the other, on the helm, the upper one being on the shaft of the tiller wheel; and mounting the tiller rope, by first attaching one end of it to one side of, and near the extremity of, the helm, passing it through a block attached to the side of the vessel, then through a block attached to the same side of the helm, then over the upper drum, and in the first groove, then under the lower drum, then around the upper drum, and in the second groove, then around the lower drum, and in the second groove, and so on to the end, each time crossing the rope, to insure the bight thereof, and then from the upper drum to a block attached to the side of the helm, and just opposite to the attachment of the rope, on the other side, and thence carrying the rope through a block at the side of the vessel, and then tying the ends to the helm, at a point just opposite to the block on the other side; so that, by this arrangement of the grooved drums, and the disposition of the tiller rope, it, (the rope,) is prevented from slipping and overriding, and, at the same time, it is prevented from making slack, as the helm vibrates, for the slack is taken up on one side as fast as it is made on the other, and the rope is also prevented from chafing."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the employment of the two grooved rollers, geared together for the purpose of preventing the rope from slipping, as described, in combination with the arrangement of the tiller rope, by having it on either side connected with the helm at two points, and also passing through a block on each side to the vessel, as herein described, whereby the making of slack, by the vibration of the helm, is avoided, as described."

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43. For an *Improvement in the Machine for Cleaning Clover Seed;* Daniel Hoats, Mifflinburg, Pennsylvania, July 20.

Claim.—"Having thus fully described my improvements, I wish it to be understood that I do not claim as my invention, the forming the cylinder in triangular ribs, or in separate rings, merely: but what I do claim as my invention, and desire to secure by letters patent, is the combination of the pyramidal teeth with the triangular ribs, as above described."

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44. For an *Improvement in the Mode of Warming the Inside of Railroad Cars;* Tappen Townsend, Albany, New York, July 24.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application, to railroad passenger trains, of the combination of the flues, connected by the elastic and flexible hose, with the openings and registers in the bottoms of the cars, as described herein, reference being also had to the accompanying drawings."

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45. For an *Improvement in the Portable Grain Separator;* Elizur L. Booth, Canandaigua, New York, July 24.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is—

"First. The screen, in its peculiar construction with rods, wires, and rough surface, in the manner described, thereby securing the jarring motion, and combining simplicity, cheapness, and efficiency in execution.

"Second. Keeping the return belt spread, by means of conical pulleys, instead of slots, and giving it motion in the direction described, to return the grain back again to the fanning mill. I claim its peculiar construction and motion, in combination with the open revolving screen, and not otherwise.

"Third. Projecting the separating concave over the revolving screen, in combination with the arrangement of the shoe.

"Fourth. I also claim the combination of the extra fan, with the screen and return belt, and its position under the belt, to break the current of air produced by the screen and return belt, and not otherwise."

46. For a *Machine for Digging Potatoes;* Allen Eldred, Oppenheim, New York, July 24.

The patentee says,—"The nature of my invention consists in the employment of a scoop, with the sides curved up, and the forward part with a point in the middle, and an oblique cutting edge on each side, extending from the front to the top of the curved side, the scoop being provided with a standard, rising from the middle of it, to form the connexion with the beam. And to this scoop is jointed a plate, with long projecting inclined fingers, or rods, on to which the potatoes and earth, dug up by the scoop, are discharged, so that the earth may drop through the spaces between the teeth or fingers, whilst the potatoes are forced up the inclined plane formed by the fingers, and are discharged above the surface of the earth, to be readily gathered.—The plate from which these fingers project, is connected with the scoop by means of a single bolt, on which it vibrates, by means of tappets or cones, on the faces of a wheel, to shake the earth, and facilitate the separation of the potatoes therefrom."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of the inclined fingers, in combination with the scoop, for the purpose and in the manner substantially as herein described. And I also claim giving to the fingers a vibratory motion, the better to separate and discharge the earth, substantially as herein described."

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47. For *Improvements in the Apparatus for feeding Nail Plates to Nail Cutting Machines;* Amos L. Reed, Pittsburg, Pennsylvania, July 24.

The nippers that hold the nail plate are on the end of a spindle, that is pushed towards the cutters, by the gradual winding of a cord attached to its rear end. This spindle slides freely through a sleeve, that turns freely in a frame hung upon trunnions, so that at the end of each cut, an arm is lifted, by a cam on the main shaft, to lift the frame, that the nail plate may be lifted from the bed cutter, preparatory to turning it over, which is done by the same cam, that vibrates a sector arm, connected, by two belts on opposite sides, with the rotating sleeve, so that the vibration of the sector arm, gives half a revolution to the sleeve, and also to the spindle that carries the nail plate.

Claim.—"Having thus fully described the nature of my improvements in the apparatus for feeding nail plates, what I claim therein as new, and desire to secure by letters patent, is the manner herein described, of combining the apparatus for withdrawing and turning the nail plate, with that for raising the feeder; this being effected by an arrangement of parts substantially the same with that herein fully made known."

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48. For an *Improvement in the Washing Machine;* Joseph Greenleaf, North Yarmouth, Maine, July 24.

Claim.—"Having thus fully set forth my invention, I wish it to be distinctly understood that what I claim, is the confining apron, in combination with the main cylinder of slots, and the fluted rollers over the same; the whole being arranged, and made to operate together, and upon the articles to be washed, substantially as herein before specified."

49. For a *Safety Lock;* James Atwater, New Haven, Connecticut, July 24.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of a sliding plate of hardened steel, or other material, constructed and operating substantially as herein described, to the outer plate of any lock for chamber or other doors, (which require to be locked on either side, at the option of the occupant of the apartment,) so as to close the key hole on the outside by the operation of the key, as described, when the door is locked from within, and thereby render it impossible for the lock to be picked from the outside, even with the aid of the proper key; while, when the door is unlocked, it may then be locked and unlocked from the outside, the same as any common lock, without operating on the sliding plate, as herein described.

"And I hereby disclaim all and singular, the other parts of the lock, as heretofore known and used."

50. For an *Improvement in the File for Filing Metals;* Richard Flint, Meriden, Connecticut, July 24.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is a round file, cut by means of a right and left hand screw or screws, substantially as above set forth."

51. For *Improvements in the Electro-Magnetic Fire Alarm;* Addison Smith, Perrysburg, Ohio, July 24.

The patentee says,—"These effects are produced by galvanic agency, the galvanic fluid being supplied by a constant battery, formed by burying in the moist earth, a sufficient surface of positive and negative metals. The circuit of this battery is formed by an insulated copper wire, passing from one pole of the battery to the other, thence returning to the former pole through the moist earth."

Claim.—"Having thus fully described the manner in which I construct, arrange, and combine the respective parts of my electro-magnetic fire alarm, I do hereby declare that what I claim as new therein, is the manner herein described, of constructing what I have denominated the connecting apparatus. And I likewise claim the combination of the connecting with the designating apparatus, arranged and operating as herein described; not intending, however, by this claim, to limit myself to the precise form of the respective parts as represented, but to vary these as I may deem expedient, whilst I attain the same end by means substantially the same."

52. For an *Improvement in the Town or Turret Clock;* Charles F. Johnson, Oswego, New York, July 28.

Claim.—"Having thus fully described the nature of my improvements in the manner of constructing town or turret clocks, and shown the manner in which I arrange and combine the respective parts thereof, what I claim therein as new, and desire to secure by letters patent, is the giving motion to the parts of such clocks as are concerned in carrying the hands, and in striking the hours, by the employment of a small timepiece, which is to raise a light hammer, and to allow it to fall at determinate intervals, and, by its momentum, to disengage a pendulous body, or pendulum, connected with the hands and other parts of the dial work, substantially in the manner herein set forth. I also claim the manner of operating the striking parts of such clocks, by the action of a hammer, at the end of every hour; said hammer being operated upon by means of the apparatus that governs the motion of the hands, and substantially as herein described; it being understood that the numbers herein given are not absolute, but relate to proportion only.

"I have already stated that turret clocks, so constructed, may be made at half the cost of those in general use; but, besides the point of economy, they are more accurate than others, as, the timekeeper being entirely detached from the apparatus which moves the hands, the powerful action of the wind on said hands has not the slightest influence on the rate of going."

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53. For an *Improvement in the Smut Machine for Cleaning Grain;* H. D. Reynolds, Mill Hall, Pennsylvania, July 28.

Claim.—"I wish it to be distinctly understood, that I do not make claim to a set of beaters, connected with the shaft by arms at each end, instead of closed ends or heads; nor do I claim making a cylindrical covering or case with wire gauze, and opened or wire gauze ends, as these separately have long since been known; but what I do claim as my invention, and desire to secure by letters patent, is the combination of the rotary beaters, with open ends, in combination with the wire gauze ends of the case or covering, for the purpose of admitting a current of air at each end of the machine, to equalize the action of the beaters on the grain, throughout the length of the machine, and more effectually to discharge the impurities, as described."

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54. For an *Improvement in the Escapement for Watches;* Charles E. Jacot, New York, July 28.

Claim.—"I do not claim to have invented a new watch; but I do claim as new, and of my own invention, and desire to secure by letters patent, the application of a roller on the balance staff made of ruby or agate, or other proper material, fitted with a groove to take the end of the lever, and the combination therewith of a crown or contrale wheel, fitted or constructed with conical teeth having radial axes, and acting conjointly with pallets fitted to coincide with the wheel teeth; the whole constructed and operating substantially as decribed."

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55. For *Improvements in Locomotive Steam Engines;* Ross Winans, Baltimore, Maryland, July 28.

Claim.—"Having thus fully set forth the nature of my improvement, what I claim and desire by letters patent is the employment of wheels of small size, as above mentioned and described, with wrought or soft iron flanches, in combination with an engine having six or eight driving wheels with axles, parallel to each other, and accommodating itself to curves and turnouts, by any of the devices or modes herein described for that purpose, and having the power applied to all the axles by connecting rods and cranks."

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56. For an *Improvement in Chairs;* Jonathan Knowles, Lowell, Massachusets, July 28.

The patentee says,—"The peculiar nature of my improvement consists in making the legs of a child's chair to fold down upon or against the bottom thereof, in order that the said chair may be applied to a truck or carriage whenever circumstances may require the same.

Claim.—"Having thus set forth my invention, I shall claim the manner in which I am enabled to adapt a chair to a carriage or truck, or another chair, as above set forth; the same consisting in combining with the bottom of said chair the stationary cleats and folding legs applied to them as above described."

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57. For an *Improvement in Sleighs;* Moses Miller, Fort Ann, New York, July 28.

Claim.—"Having thus fully described the manner in which I arrange and combine those parts of my sleigh in which my improvements are found, what I claim therein as new, and desire to secure by letters patent, is the within described manner of combining the dash board with the raves or frame work of the sleigh; the dash board being affixed on the outside of the raves, thereby admitting of its being widened out so as to constitute wings, whilst under the peculiar arrangement set forth it may be disconnected for the purpose of repair, and replaced at pleasure. To this manner of combining the dash board with the raves I limit my claim."

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58. For *Improvements in the Machine for Making Spikes;* William Hatch, Medford, Massachusetts, July 28.

We have to omit the claims in this instance on account of their reference to, and dependence on, the drawings. The general character of the invention will be understood from the following extract from the specification, viz.—"My machine is calculated to perform upon a heated rod of metal, the operations of dividing or cutting it off into lengths necessary to form spikes, of rolling and pressing down two opposite sides of each of said lengths to an angular point, of forming a head upon the end of each length, opposite to that on which the point is performed, and finally discharging the spike (when thus completed) from the machine."

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59. For an *Improvement in the Hot Air Stove;* Evans Backus, Brooklyn, New York, July 28.

The patentee says,—"It has long been considered a desideratum in stoves for heating apartments, to form them as compact as possible, while at the same time air is brought into contact with the greatest convenient amount of heating surface, by which economy and comfort are combined. By the construction which I have invented (as hereafter described) I have a compact pedestal or conical stove without any exterior flues, side pipes, or heaters, while a rapid and constant circulation of the air of the room is secured in contact with the heating surface."

Claim.—"Having thus fully described my improvement, what I claim as my invention, and desire to secure by letters patent, is the descending and ascending flues of the stove and air chamber in the manner described, and surrounded by a case, substantially as herein set forth."

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60. For an *Improvement in Fish Hooks;* Theodore F. Engelbrecht & G. F. Skiff, New York, July 28.

This improvement consists in jointing to the stem of a fish hook another hook which is forced down by a spring. When set for fishing the extra spring hook is held up by a sliding catch connected with the line, and when the main hook that carries the bait is pulled by the fish, this liberates the spring hook, which catches on to the fish.

Claim.—"What we claim as our invention and desire to secure by letters patent, is the construction of a self-acting spring and slide lever hook for catching fish, constructed as above described; and whether spiral or other springs are employed, or whether the lever is made to descend by being disengaged from a slide, operating as herein described, or by any other analogous process. We also claim the invention of a hook for catching fish, operated by a spring, a lever, and a slide, whether working as described above, or in any other way."

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61. For a *Machine for Cutting Screw Bolts;* Smith Groom, Troy, New York, July 28.

Claim.—"What I claim and desire to secure by letters patent, is the arrangement of nuts or bolts, or either of them, in such manner that while the cutting tool, attached to one end of the shaft, retraverses the thread of the nut or screw last cut, it necessarily forces the cutting tool at the opposite end up to, and makes it operate upon, the bolt or nut next to be cut."

62. For an *Improvement in the Yoke for Working Horses;* E. H. Danforth, July 28.

Claim.—"What I claim as my invention, and wish to secure by letters patent, is, first, the connecting of the whiffletrees and eveners with the hames, in the manner above stated, thus attaching them to the necks and shoulders of the horses.

"Second. The manner of attaching the whiffletrees and eveners to each other, and the latter to the bar, so as to produce the motion, as above described."

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63. For making *Tyre for Railroad Wheels;* D. Saunders, of Cincinnati, Ohio, J. G. Bisset, of Covington, Kentucky, and S. Saunders, of Pittsburgh, Pennsylvania, July 28.

The following is the mode of procedure:—A pile of iron and steel is made as follows; first a large bar of iron, then a thin bar of steel, then another bar of iron, the latter being thin, and serving only as a protection to the steel from being burnt in the process of welding, the whole is then welded. The bar is then passed through a series of rollers giving the required shape to the tyre, shrunk on to the wheel, and the thin plate of iron turned off to expose the steel to the surface.

Claim.—"What we claim as our invention, and wish to secure by letters patent, is the manufacturing tyre for railroad wheels, as herein described."

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64. For an *Improvement in Veneering;* T. R. Hibbard, assignee of Augustus McBurth, New York, July 28.

"The nature of my invention consists in interposing between the veneers, or veneer and body to which it is to be attached or united, or layers of wood to be united, a cotton or linen canvass, or other cloth, (the cloth and parts of the wood to be adjoined being first covered or prepared with glue or other adhesive material,) and then placing the parts to be united in juxtaposition; the cloths prepared as aforesaid being interposed, and uniting them by any of the known or suitable modes of compression. The cloth thus interposed adheres firmly to every part of the adjacent wood, and prevents the veneer from splitting or cracking with the grain of the wood, or leaving the body to which it is attached; renders two veneers minutely thin, thus united, stronger and more durable than if united in the usual mode, and than solid wood of many times its thickness or size.

"This invention is peculiarly adapted to the veneering or formation of unequal surfaces, or to cases where the veneering wood is required to be bent or compressed out of its natural inclination. It is especially adapted to the construction of wooden tubes or pipes. The mode I adopt in the constructing of tubes or pipes is the following: A veneer or layer of wood is first rolled around a rod or shaft attached to a crank, and turning with it and compressed by a cord, (I have used,) or other compression, into the required shape. The cloth, saturated with glue or other adhesive substance, is then rolled tightly around the veneer thus shaped as above, and then another veneer, or layer of wood, is applied upon the cloth and compressed, by the means above stated, into contact with every part of the cloth; by turning upon which, the veneers are shaped or rolled over a furnace, and the glue or adhesive matter is made to penetrate every part of the fabric."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the use or application in veneering or uniting layers of wood, of linen, cotton, canvass, or other cloth, covered or prepared with glue or other adhesive substance interposed between the veneers or layers of wood to be united, or veneer or body to which it is to be united, substantially as described, whether this be employed for making tubes or pipes, constructed as above, for the purpose to which they may be suited or applicable, or to any other purpose."

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65. For an *Improvement in the Surveyor's Compass;* Samuel Kern, Strasburg, Virginia, July 31.

The patentee says,—"The surveyor's compass has heretofore been an expensive instrument, and one difficult of adjustment and use, but my construction and arrangement of the parts thereof renders it at once cheap and efficient, enabling one to use it as a compass for running lines or for leveling as may be required."

Claim.—"Having thus fully described my improvement, I wish it to be understood that I do not claim as new the dial-plate, the compass-needle, or the sights, as they have long been known and used, but in a different combination. What I do claim as my invention, and for which I desire letters patent, is the combination of the dial-plate, compass-box, and sights, in the manner set forth; the compass being placed under the surface of the dial, and the bar on which the sights are placed above it, so that it can have an entire sweep around the circle tangentially, in the manner and for the purpose described."

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66. For a *Machine for Preparing and Cleaning Potters' Clay;* S. Miller & G. Roller, Carrol county, Maryland, July 31.

This machine consists simply of a lever press, the follower of which is fitted to slide in a box that has a perforated bottom through which the clay is forced.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the principle of cleansing and tempering potters' clay, by forcing it through a sieve or screen, as herein described."

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67. For an *Improvement in the Corn Sheller;* Lorenzo B. Glover, Easton, Connecticut, July 31.

The object of this machine is to separate the corn from the cobs after it has been shelled; but as the drawings are very imperfect and the specification covers some nine or ten folio pages, we will be under the necessity of omitting any further description.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is—

"First. The open wheel, constructed as above described.

"Second. The arrangement of the bars and teeth upon the revolving wheel, by which the revolution of the cob is produced.

"Third. The arrangement of the teeth upon the lower surface of the upper wheel, by which the cob is permitted to escape from between the wheels when the corn has been disengaged from it."

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68. For an *Improvement in the Machine for Cutting Shingles;* Jonathan Bennet, Amenia, New York, July 31.

Instead of having one knife attached to a sliding gate to cut one shingle from a block at each operation, there are under this improvement two of them, one above the other, and reversed so that the first cuts the but from one end of the block, and the other follows cutting it from the other end. There is a spring rest which is forced back after the first shingle is cut to permit the first knife to pass.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the peculiar arrangement of the knives in combination with the gauge-plates and spring-rest in such way that their combined action shall effect the production of two shingles at one complete downward motion of the gate, cutting *both* from but to tip *without changing* the block or shingle bolt."

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69. For an *Improvement in the Boiler for Boiling Water;* Jason L. Burdick, Norwich, New York, July 31.

Claim.—"Having thus fully described the manner in which I construct my boiler, and combine it with a vat in which water is to be boiled, what I claim therein as new, and desire to secure by letters patent, is the particular arrangement and combination with the furnace of the water-heating tubes that pass through the furnaces; these tubes having the lateral tubes opening into them from the vat, by which a perpetual circulation of the water is obtained, and the tubes are prevented from being burnt out.

"I do not claim the combining of heating furnaces with vats, but I limit my claim to the particular device above set forth."

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70. For an *Improvement for holding up the Tail of a Horse after Nicking;* Gibbons Gray, West Chester, Pennsylvania, July 31.

Instead of attaching the horse's tail to the stall or roof, it is connected with a semi-hoop or bale attached to the back of a saddle, and this bale is in turn connected with the cantle of the saddle by means of springs, so that the same tension is kept on the tail in any position which the horse may assume.

Claim.—"Having thus described my apparatus and its mode of operation, what I claim therein as new, and desire to secure by letters patent, is the apparatus constructed substantially as herein set forth, so as to be attached to the back of the horse, and serve to elevate his tail when he is in any position; arranged and combined in the manner and for the purpose set forth herein."

Improvements added to existing Patents during the month of July, 1846.

For an *Improvement in the Horse Hames;* Nathan Post, Porter, New Jersey, July 14, added to patent of June 5, 1844.

The patentee says,—" My new improvement consists in superseding the use of the levers which pass through the draught hooks, and which were coupled together by a strap and buckle, or chain and hook as specified in the schedule annexed to the aforesaid letters patent, and substituting therefor a more simple mechanical arrangement for performing the functions of said levers, which said levers in connexion with the draught hooks specified in the schedule before referred to, kept the hames in their proper position on the collar."

Claim.—" What I claim therefore as my invention and desire to secure, is the combination of the lever shoulder on the clips with the draught hooks and hames, the purpose and operation of said combination being substantially as above set forth."

List of American Patents which issued in the month of May, 1842, *with Exemplifications, by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

21. For an *Improvement in the Water Wheel;* Abijah Woodward Swanzey, New Hampshire, May 12.

Claim.—" What I claim as my invention, and desire to secure by letters patent, is the combination of the buckets and wings, in the manner described, with the penstock, having a ring and projection arranged as herein set forth."

The buckets project radially from a hub, with a curvature backward at their outer end, and, from their lower edges, wings are extended downwards, spirally, with an increasing curvature. To this wheel is adapted a penstock, having a ring, extending out over the rim of the wheel, and under the ends of the buckets.

22. For an *Improvement in the Method of Propelling Boats;* Truman Cook, New York, May 12.

We are under the necessity of omitting the claim, as it could not be understood without the drawings to which it refers.

The general principle on which this propeller operates, is that of sculling. On each side of the boat there is a vibrating arm, having a paddle at the end thereof, with a shifting fulcrum, so that the paddle shall act to propel the boat forwards, when the arm vibrates in either direction.

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23. For an *Improvement in the Spring Perch for Carriages;* Stephen Tomlinson, Bridgeport, Connecticut, May 16.

The patentee says,—"The nature of my invention consists in providing a spring perch, for carriages having elliptic springs, by which they can be constructed with less weight, with greater strength and durability, with an increased amount of spring, and the fifth wheel above the elliptic spring."

Claim.—"What I claim as my invention, and what I desire to secure by letters patent, is the application of a spring perch, as above described, to carriages of any size and description, which will combine the advantages above described, using, for that purpose, any material which may accomplish that purpose."

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24. For *Improvements in the Loom for Weaving Carpets;* Erastus B. Bigelow, Lancaster, Massachusetts, May 16.

The mechanism of this loom, including, as it does, some important modifications of the jacquard, is necessarily very complex, and, without a full description, the claims could not be understood, and therefore, we omit them; and this we do the more readily, as it is our intention to give, in a series of articles, a full account of all the improvements in the art of weaving, which have been patented in this country since the re-organization of the Patent Office, in 1836.

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25. For an *Improvement in the Plough;* Cornelius Bergen, Brooklyn, New York, May 16.

Claim.—"The improvement I claim as my invention, and desire to secure by letters patent, is, first, the peculiarity of the form of the mould board, as produced by the combination of the increased twist and wedge, the advantages of which are, that it materially lessens the friction, and consequently the traction or draught is much diminished; the scouring is more uniform on every part of it, which causes it to do its work in a superior manner. Second, the manner in which the point and share are formed, and held to the mould board, the peculiarity of their construction, and the manner in which they are held in their place, by means of the gripe, which enables them to be made of cast iron, instead of wrought, sufficiently strong for all purposes, and, consequently the annual cost is much cheaper. Third, the additional piece, to heighten the mould board when desired, the advantages of which are, that a second slice may be taken out of the bottom of a furrow, previously made, and cast completely above, which answers the purpose of trenching, as performed with a spade: it is also of great service when ploughing weedy ground; all as herein described."

26. For an *Improvement in the Grate for Open Fire Places;* James Easterly, Troy, New York, May 16.

Claim.—"Having thus fully described the nature of my improvement, in those grates which project out from the jambs in open fire places, what I claim therein as new, and desire to secure by letters patent, is the making the projecting ends, or sides of the body of such grates, of plates of metal, by which the said ends are closed, and air is admitted at the front of, and under, the fire only, in the manner and for the purpose herein set forth."

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27. For an *Improvement in the Manufacture of Glass Knobs, and other like articles;* William S. Thompson, of Cambridge, & A. C. Hobbs, of Boston, Massachusetts, May 20.

Claim.—"Having thus explained our invention, we shall claim protecting the gold or silver leaf, or foil, which covers that part of the glass inserted in the metallic socket, from injury, during the above described operation of cementing the parts together, by the japanning compositions, previously applied thereto, and indurated by heat, substantially in the manner, and on the principles above set forth.

"Also, protecting the leaf or foil by means of a covering of muslin, oiled cloth, or other suitable fabric laid and covered over the same, and having its outer surface covered with a coating of varnish, japanning, or other suitable material as described."

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28. For *Improvements in the Double Cylinder Printing Press;* Richard M. Hoe, New York, May 20.

Claim.—"What I claim as new, and desire to secure by letters patent, is, first, the particular arrangement of the spiral or other springs, levers, pistons, and their appendages for arresting the momentum of the bed, the springs being placed on or near to the foundation or base of the machine, and being connected with the levers which receive the blow of the bed at either end, as its motion is about to be reversed, the whole arrangement and operation being substantially the same with that herein described.

"Secondly, I claim the manner herein set forth of combining and arranging the apparatus for raising and lowering the pressing cylinders; that is to say, I claim the manner of governing and regulating this motion by means of a pinion placed on the main driving shaft, and operating upon a wheel carrying a cam, which actuates a rocking piece, connected with toggle joints, or progressive levers that raise and lower the respective cylinders, alternately, through the intermedium of an apparatus arranged substantially in the manner herein fully made known."

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29. For a *Stay Truss or Umbilical supporter;* Maria P. Dibble, New York, May 20.

We cannot give the claim as it refers to the drawings, and could not be understood without them; but it is limited to the combination of the belts and springs constituting the umbilical supporter with the corset.

30. For a *Cut-off Valve for Steam Engines;* F. E. Sickels, New York, May 20.

As this invention is now extensively known and used, we will simply give the claims on which the patent is granted.

Claim.—"Having thus fully described the nature of my improvements in the apparatus for lifting and tripping the valves of steam engines, and of thereby cutting off the steam any required part of the stroke; and also of my improved apparatus for regulating the closing of the valves; what I claim therein as new, and desire to secure by letters patent, is, first, the manner in which I have combined and arranged the valve stem, the spring on the lifter, the adjustable sliding piece with its wedges or inclined planes, and their immediate appendages, so as to co-operate with each other, and to effect the tripping of the valves and the cutting off the steam, substantially in the manner set forth.

"I also claim the manner of regulating the closing of the valves and of effectually preventing them from slamming, by means of a water reservoir furnished with a piston or plunger attached at the lower end of the valve stem, and operating within an adjustable cup or secondary reservoir, so as to effect the purpose intended; upon the principle, and substantially in the manner herein made known and described."

31. For an *Improvement in the Saw Mill, for sawing Felloes and other Circular Work;* Isaac Sheetz, Taney town, Maryland, May 20.

Claim.—"What I claim therein as new, and desire to secure by letters patent, is the manner in which I have arranged and combined the two lower frames or platforms, and the carriage, so as to allow the upper platform to shift on the lower, and the centre of motion of the carriage to be changed, the same being effected in the manner and for the purpose herein fully set forth and made known."

32. For an *Improvement in the Bee Hive;* D. H. Farnham, Litchfield, Connecticut, May 20.

The claim is limited to making the hives with sliding bottoms, and the honey boxes with sliding covers.

33. For an *Improvement in the Tuyers for Forges;* William W. Snow, Oneonta, New York, May 20.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is constructing the connecting pipe, the segment of a curve, in combination with the changeable hoods made in the manner and for the purpose set forth."

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34. For an *Improvement in Matches;* George W. Carleton, Bath, Maine, May 20.

The patentee says,—"I take two pounds of Arabic or other viscid substance, and dissolve in as little water as possible, I then deposit in a bottle holding one gallon, one and one-fourth pounds of the best phosphorus, and add to it enough of my diluted Arabic to cover the same. I then immerse my bottle in hot water for the purpose of fusing the phosphorus, and when it becomes fused, I give the contents violent shaking in order to subdivide the particles of phosphorus: then, to prevent their re-union, I add the remainder of my Arabic, and mix by shaking. I then add to it a fulminating compound composed of the following articles, viz.: two pounds of sub-carbonate of potass, three pounds nitrate of potass, and one pound of sulphur, I then grind all the ingredients together in the manner of grinding paint, and put up for future use or exportation suitable for the same.

Claim.—"What I claim as my invention, and wish to secure by letters patent, is a paste for making friction matches of the materials herein described, thereby dispensing with the non-combustible ingredients of other ignitible compositions of matter, causing my ingredients to enter into the support of the combustion, and making use of so large a quantity of phosphorus, as is generally used, entirely unnecessary."

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35. For an *Improvement in the Mode of Regulating the Heat of Stoves;* Elisha Foote, Jr., Seneca Falls, New York, May 26.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of the expansive and contracting power of a metallic rod by different degrees of heat to open and close a damper, which governs the admission of air into a stove or other structure in which it may be used; by which a more perfect control over the heat is obtained than can be by a damper in the flue.

"I also claim as my invention, the mode above described of setting the heat of a stove at any requisite degree, by which different degrees of expansion are required to open or close the damper.

"I also claim the combination above described, by which the regulation of the heat of a stove or other structure in which it may be used, is effected; and I also claim as my invention the mode above described of connecting the action of the metallic rods with the damper, so that the same may be disconnected when the damper shall have closed, and the heat shall continue to rise, &c."

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36. For an *Improvement in the Pneumatic Engine;* John R. Remington, Aberfoil, Alabama, May 26.

Claim.—"I do not claim to be the inventor of the principle of giving a reciprocating movement to a piston in a cylinder, by a vacuum and atmospheric pressure; but what I do claim as my invention, and which I desire to secure by letters patent, is the before-described combination of the exhauster with the fire box, air receiver, cylinders, and pistons, and the several valves, connecting rods, cranks, and elbows for opening and shutting the valves and operating the pistons, as herein set forth."

37. For an *Improvement in the Door Lock;* G. M. Zahm, Lancaster, Pennsylvania, May 26.

This claim could not be understood without the drawings.

38. For *Improvements in Looms for Weaving Carpets and other Figured Fabrics;* E. B. Bigelow, Boston, Massachusetts, May 26.

The reason for omitting the claims of this patent will be found at No. 24 of the present list.

39. For *Improvements in the Instrument for Measuring for the Cutting of Garments;* P. F. L'Veret, Warrenton, Georgia, May 26.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the construction and combination of the morphographer in its different parts and its application to the measurement of the human body, and transferring said measurement to the cloth, thereby enabling the practical tailor to furnish his customer a body garment accurately fitted and adapted, in all respects, and in every instance, to the person."

Legal Decision by the Circuit Court of the United States, New York, before Judges Nelson & Betts, *in the case of Tatham's patent for Lead Pipe Machinery.*

George N., Benjamin Jr., and Henry B. Tatham, *vs.* R. W. Lowber, Thomas Otis Leroy, and David Smith.

The motion for an injunction against the defendants in this case to restrain them from an infringement of a patent for lead pipe machinery, came up for argument on the 7th April inst. [1847.]

The plaintiffs claimed as American patentees under an assignment from C. & J. Hanson, the alien inventors.

The patent was resisted upon several grounds. Among them were

1st. Want of novelty of invention. The defendants cited the machines of T. Burr, J. Hague, B. Titus, G. W. Potter, Jesse Fox, and several others.

2nd. That the 15th sec. of the act of 1836, provides for a forfeiture of a patent if it can be proved "that the patentee, if an alien, at the time the patent was granted, had failed or neglected for the space of eighteen months from the date of the patent, to put and continue on sale to the public, on reasonable terms, the invention or discovery for which the patent issued." It was contended that this provision applied to the American assignees and patentees,—and that in fact a forfeiture had occurred by such failure and neglect.

3rd. It was urged that a patent for this invention was originally issued in England; that it was first obtained in the U. S. in 1841, with a specification differing from the English patent; and that it had been surrendered and reissued in 1846 with a new claim differing from both.

4th. That the defendants, Leroy and Smith, were not the owners of the machine—but merely supplied the material and sold the product:

There were other points of minor importance, and all of them were denied by the plaintiffs. The argument occupied the court four days, For the plaintiffs, George C. Goddard, Charles O'Connor, and S. P. Staples, Esqs. For the defendants, William Curtis Noyes, and Daniel Lord Jr., Esqs.

The decision of the court was given on the 21st. inst., as follows:

" We are satisfied

1st. The specification of the patent to plaintiffs (reissued 16 March, 1846) claims as the invention a combination or arrangement of the parts of machinery described; by which pipe, with the operation of hydraulic pressure, is made with lead in a *set* or semi-fluid state.

2nd. That the machine used by the defendants is in substance the same as plaintiffs.

3rd. The patentees can legally take out the reissued patent for more than was described in the surrendered one, if it does not exceed the actual discovery when the first was taken out.

4th. The evidence satisfactorily establishes that the Hansons were the first and original discoverers of the combination or arrangement embraced in the patent.

5th. The patentees after the assignment of the right and the grant of the patent to them, took and held it, with all the privileges of an American patent, and the alien clause in the 15th sec. of the act of 1836, applies only to alien patentees, and not to American assignees.

6th. But even if the assignee takes the right with the limitation or condition of the alien, still the plaintiffs have satisfied the act. They need not prove that they hawked the article about for a market, and that they tried to sell it to any person. Those seeking to defeat the patent must prove the plaintiffs neglected or refused to sell for reasonable prices when application was made to them.

7th. The sales by the plaintiffs, and those they proposed, and offered, were of the invention or discovery within the meaning of the act.

8th. The proof is sufficient to charge all the defendants directly and indirectly with using the machinery and violation of the plaintiffs' right.

Let an injunction therefore issue." New York Cour. and Inq.

SPECIFICATIONS OF ENGLISH PATENTS.

Specification of Patent granted to James Napier, *of Shacklewell, for Improvements in Smelting Copper Ores. Patent dated July* 20, 1846. *Enrolled January* 20, 1847.

When the ore contains less than 20 per cent. of copper, and more than two parts by weight of sulphur, to four parts of copper, it is first to be calcined, and then melted in the ore furnace—the slag removed, and tapped into sand or water, in the usual manner. When the ore contains less than 20 per cent. of copper, and less than two parts by weight of sulphur, to four of copper, it is to be mixed with ore, containing excess of sulphur, until it is brought to the same proportion as the above or thereabouts; this is then also to be calcined and fused, as above described. But, when the ore contains more than 20 per cent. of copper, and not less than one part of sulphur, to four parts of copper by weight, the calcining and fusing above described may be omitted, and the ore proceeded with directly, according to the method hereinafter described.

The products in the first and second cases, and the ore in the third case, mentioned above, the patentee denominates "coarse metal." To every ton of this coarse metal is added, in the metal furnace, 56 lbs. of soda ash, containing about 50 per cent. of alkali, and 56 lbs. of slaked lime. and the whole melted together. When fused, the slag is to be removed, and for every ton of metal add 1 cwt. of scrap iron; this should be spread evenly over the surface of the melted mass, then the furnace door is to be closed, and the whole brought to a state of fusion; the door is then opened, and the mass well and rapidly mixed, and immediately run off into sand moulds. As soon as the mass is sufficiently set, it is to be put in pits containing water enough to cover the mass; in a short time the mass falls to powder, the surplus water is run off, and the powder heaped up still moist, and allowed to remain for 24 hours. It must then be washed with water—and for this purpose the patentee makes use of a large wooden box, having a double pierced bottom, between which is placed wire gauze, from 25 to 35 meshes to the inch; this box is placed over what is called (by copper smelters) a tap-water pit, a vent is placed below the bottom of the box, and over the aperture of this vent, a wire gauze is fixed, of from 60 to 70 meshes to the inch; this vent is kept closed till the box is full of water—the water is then let off by opening the vent. This is to be repeated. It is then removed to the ordinary calcining furnace, and heat applied; very moderate at first, but gradually increased for 20 hours, till it is of a bright yellow heat; this heat is to be kept up for six hours longer, care being taken that the heat never rises sufficiently high to cake or fuse the powder; the powder is then withdrawn, and water sprinkled on it—then removed to the melting furnace, and to every ton of powder, 112 lbs. of anthracite coal, also in powder, and 10 lbs. of sand, are added; and, if the sample should be very infusible, a small quantity of slaked lime or fluor-spar must be added as a flux. When melted, the slag is to be removed, and more of the mass added, repeating the process till the furnace is full. The furnace is then tapped, and run into sand or water. It is generally the case that the metal is found fit for the refining furnace; but should there be any regulus, this, as it is rich in copper, is to be roasted and melted. The slag obtained in this part of the process is re-melted with the ore in the ore furnace, and acts as a flux.

The claim is for the application of iron, and an alkali in smelting the ores of copper, and water for the purpose of disintegrating and decomposing the mass formed by such application. Min. Jour.

Specification of Patent granted to Mr. Thomas Payne, *of Wandsworth, near Birmingham, for Improvements in the manufacture of Rolls, for Rolling Iron and other Metals. Patent dated August* 4, 1846. *Enrolled February* 4, 1847.

This invention relates to improvements in the mode of rolling iron and other metals. In constructing rolls for such purposes, it has heretofore been used to cast rolls with necks, or axles at their ends, such necks or axles being liable to be broken when in use; and it has also been attempted to cast rolls on to bars of iron, such rolls of iron being intended to strengthen the axles or necks of the rolls; but in all such cases the inventor states that bars of iron so used are much injured, being weakened, and unfit for such purposes; but in order that the important peculiarities of his invention may be more fully understood, he has given (which he believes to be) the present mode of manufacturing the rolls aforesaid, that is to say—in carrying his invention into effect, the inventor states, that in casting rollers, of any given size required, it will be necessary to leave the interior of any such roller hollow, so as to admit of the shaft or axis being passed through, and fixed therein by keys or otherwise; care being taken in casting, that the hollow space within a roller is cast or formed truly, so that the shaft when introduced shall fit accurately, allowing spaces for driving in wedges or keys at the end of the roll, which keys should be securely retained from moving by shrinking wrought iron collars on the shaft or axles; the working journals are turned in the wrought iron shafts, after keying on the rolls, and the surfaces of the rolls turned; by which means of manufacturing rolls for rolling iron and other metals the inventor is enabled to obtain them with stronger necks or axles. The wrought iron shafts or axles are passed through hollow rolls, which the inventor prefers to be cylindrical openings in the cast iron rollers, but the inventor does not confine himself thereunto, as other shapes may be used; but he claims the manufacture of hollow cast rolls for rolling iron and other metals, and fixing thereunto wrought iron shafts or axles, as hereinbefore described. Ibid.

Specification of a Patent granted to Etienne Abram Maccaud, *of Paris, for improvements in lamps and gas-burners.*—Sealed 22nd October, 1846.

This invention consists in surrounding the lower part of Argand burners with a casing, having numerous minute apertures in it, or made of any suitable open tissue, through which all the air to support combustion, both that which passes upwards through the centre of the flame and that which acts upon its exterior, is compelled to pass. By this arrangement no jets or partial currents of air can affect the flame, as the air is drawn, by the action of the flame, in minute streams from all parts of the circumference of the casing; and in its passage through the casing the temperature of the air is raised, so that the casing becomes a reservoir of hot air; and as the combustion is supported by the air from the reservoir only, a steady white flame is obtained.

Fig. 1 is a vertical section of an Argand gas-burner, with this invention applied thereto; and fig. 2 is a plan view of the same. *a*, is the burner; *b*, is a casing of wire-gauze, of one thousand meshes to the square inch, connected at the upper end to the chimney-gallery *c*, and having affixed to the lower end a ring, which rests in a cup *d*, attached to the stem of the burner; *e*, is an annular passage, made in the plate of the gallery *c* (which forms the top of the air chamber), for the purpose of admitting air into the space between the chimney and exterior of the flame. The chimney is fitted accurately into the gallery, so that no air can pass between its lower edge and the plate on which it rests; and the ring at the bottom of the casing *b*, is kept in close contact with the cup *d*, so as to prevent the passage of air at that part. Instead of the chimney-gallery consisting of a solid plate, with an annular opening in it, an annular piece of wire-gauze may be fixed over the space between the exterior of the burner and the casing.

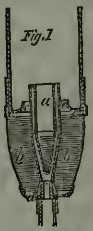
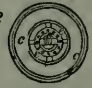


Fig. 1

Fig. 2


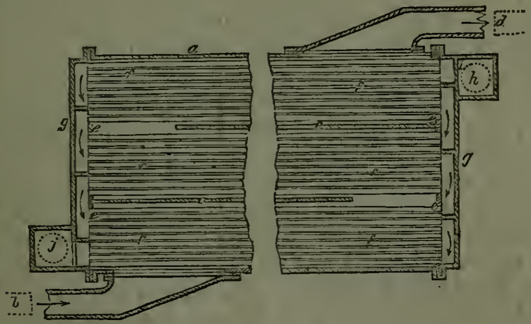
The patentee states, in conclusion, that he claims the application to lamps and gas-burners, of the kind called Argand (that is, burners having a channel for the passage of the air to the interior of the flame), of a hot-air chamber or reservoir, composed of wire-gauze, or of other tissues or materials, adapted to allow the passage of air to the flame in a minutely subdivided or diffused state; through which chamber the air is compelled to pass before it can act upon either the interior or exterior surfaces of the flame;—the improvements consisting, First,—in enclosing the whole of the space between the outer rim of the gallery or glass carriage and the bottom of the forked stem of the burner, so as to form but one chamber or reservoir for the supply of air to the burner; and, Secondly,—in admitting the air through wire-gauze, or otherwise, in such a subdivided or finely-diffused state into the said chamber, as to prevent any air, in the form of a jet, acting upon the flame.—[*Inrolled* 1847.]

Lon. Jour. Arts & Sci.

Specification of Patent granted to THOMAS HOWARD, *of the King and Queen Iron Works, Rotherhithe, in the county of Surrey, for improvements in Steam-engine Condensers.*—Sealed 25th March, 1846.

This invention relates to such condensing steam-engines as have their boilers supplied with water of condensation, and in which the steam is condensed by injecting such water, properly cooled down, into the condenser; the improvements consist in suitably arranging apparatus for cooling the water, previous to its injection into the condenser.

A longitudinal section of the apparatus employed by the patentee is shown in the annexed figure. *a*, is a tank, placed in any convenient situation, and supplied with cold water by pumps or other means; the water entering at *b*, is guided in its course through the tank by the plates *c*, and escapes at *d*. The ends of the tank are closed by brass plates *e*, in which are fixed the extremities of the tubes *f*, made of copper or other metal; and over the plates *e*, and open ends of the tubes *f*, are fixed "bonnets" *g*, divided into compartments, in the manner shown. On one bonnet there is a nozzle *h*, connected by a pipe with the hot-water cistern, and having a perforated plate *i*, fixed in it; and on the other bonnet there is a nozzle *j*, connected with the injection cock.



A quantity of water having been introduced into the hot-water cistern (by first starting the engine with the ordinary injection, or otherwise), sufficient to fill the tubes and properly effect the circulation, the injection-cock connected with the nozzle *j*, is opened, when the warm water will be caused, by the pressure of the atmosphere, to pass from the hot-water cistern, through the nozzle *h*, and to and fro along each series of tubes, determined by the divisions in each bonnet, as indicated by the arrows; by which means it will be reduced to nearly the same temperature as the water that surrounds the tubes; and, after passing through the nozzle *j*, into the condenser, the water will be discharged by the air pump into the hot-water cistern, from whence it will again pass into the tubes; any waste which occurs is made good by the ordinary injection.

The injection water and the refrigerating water may be made to change places, the former passing outside and the latter inside the tubes. The patentee recommends that the refrigerating surface be about ten feet per nominal horse power, when the steam is so employed as to leave the cylinder of the engine at ten pounds pressure per square inch, irrespective of the atmospheric pressure. He also recommends that the supply of cold water be not less than twice the quantity of the injection water.

In conclusion, the patentee says that patents were granted to him on October 13th, 1825, and November 31st, 1832*, in both of which a process of condensation by the reinjection of the same water or other liquid was included; he does not, therefore, claim such process; but he claims the so arranging apparatus that the water for condensation shall be subdivided into many streams in its progress to be cooled and used as injecting water, as described.—*Inrolled September*, 1846.

Ibid.

Extract from a Treatise on the Principles relating to the Specifications of a Patent for Inventions. By Wm. Spence, London.

Specifying Claims for Patents.—We come now to that part of the specification which, in a sense, may be said to be the most important of all: the part referred to is the claim. It is here that the essence, principle, or spirit of the invention is stated in the most distinct terms. The whole of the foregoing matter is here summed up and resolved into its one idea. All the previous description of circumstance comes now to be seen only as affording a clue to the right interpretation of this final definition of the essential character of the invention. The claim rightly understood is in fact the specification; but then in order that it may be rightly understood reference must be had to the antecedent matter: and it may indeed be said that the intelligibility of the whole specification greatly depends upon the particular interpretation of the claim which is suggested by such reference. It would be comparatively easy to discover what construction to put upon the claim, provided all the former portions of the specification plainly referred to the main idea contemplated by the invention, but such construction becomes a difficult matter when inconsistencies are found to exist on a comparison of some statements with others. So far as difficulties of this kind can be overcome, they are sometimes obviated by stating the claim first in a negative form. It is well to calculate upon every objection being raised to the specification that human ingenuity can devise: and accordingly it may be foreseen that the true, distinct nature of the invention is left open to misconstruction by a mere statement of what it is, since it may appear to be not only that, but something more also, (probably of a prejudicial character,) unless guarded from such construction by a suitable negation. This course is particular advisable when the patent is for a new combination of materials or processes, which in their separate form are old or not open to be claimed. Crane's patent is a case in point. It is described as consisting in "the application of anthracite or stone-coal, combined with a hot-air blast in the smelting or manufacture of iron from iron-stone, mine, or ore." Now the patentee, in this case, feeling that the ground to be occupied by his invention is narrow, proceeds in his specification very carefully to lay such a foundation as will lead to a right apprehension of his real subject-matter. He shows, that is, the importance in a commercial point of view of using the stone-coal in the manufacture of iron: and thence infers that the abandonment of the article after use (which he cites as a known fact) was owing to some imperfection in the means employed to adapt it to the purpose. He accordingly gives instructions as to a practical mode of applying it to this use, the essential feature in which is the adaptation thereto, and combination therewith, of the hot-air blast. And after describing the mode by which he had actually accomplished his purpose, he says:—"I would have it understood that I do not claim the using of a hot-air blast separately in the smelting and manufacture of iron, as of my invention, when uncombined with the application of anthracite, or stone coal, and culm: nor do I claim the application of anthracite, or stone-coal in the manufacture or smelting of iron, when uncombined with the using of hot-air blast. But what I do claim as my invention is the application of anthracite, or stone-coal, and culm, combined with the using of hot-air blast in the smelting and manufacture of iron from iron-stone, mine or ore, as above described."

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*For description of these improvements see London Journal of Arts, Vol. XIV, First Series, p. 181 ,and Vol. XIII, Conjoined Series, p. 385.

The claim being in this form anticipates any objection that might be raised on the ground of interference with the hot-air blast patent of Neilson, except that Crane must take a license from him to use that part of the combination. It also avoids the objection of including what was known to be old in the manufacture of iron, so far as a series of (it would appear unsuccessful) efforts to make stone-coal available for the purpose could render it so. But it likewise sets at rest all uncertainty as to the real subject-matter of the patent by the positive form in which the claim is stated. So that the whole effect of the claim may be stated as follows:—"Although the patent is not for the use of hot-air by itself (that is Neilson's), nor for the application of anthracite or stone-coal without the use of hot-air blast (that has been tried and has failed), yet it is for the application of anthracite or stone-coal combined with the use of hot-air blast for the manufacture of iron." And the only question that arises on the claim so stated is whether the subject-matter of a patent can stand upon such narrow ground. To this question the Court of Common Pleas answered in the affirmative—such opinion, in this case, resting upon the fact that the balance of the evidence at the trial showed a substantive effect to have resulted from the combination, viz., an improved quality of iron at a diminished cost of production. It would seem that before the date of this patent the application of anthracite or stone-coal to the manufacture of iron was felt to be a desideratum, but one which was not attained: the patentee, however, succeeded in producing better iron at a cheaper rate by the use of this article. To what cause then is his success attributable? The essential difference between his mode of operation and that practised by his predecessors was, that whereas they used stone-coal uncombined with a hot-air blast, he used it in combination therewith, and this being the only essential distinction between the two modes, to such is ascribed the difference of result.

Civ. Eng. & Arch. Jour.

FRANKLIN INSTITUTE.

Monthly Meeting, July 15, 1847.

Mr. Reid, Superintendent of the Magnetic Telegraph Company, exhibited and explained the operation of an ingeniously contrived machine invented by him for preventing the action of atmospheric electricity during thunder storms, from injuriously affecting the apparatus used in telegraphic communications. Mr. R. said that the efficiency of this contrivance was fully tested during the thunder storm of Tuesday evening last, when the interruption caused by the heaviest discharges of atmospheric electricity produced only a momentary derangement of the writing apparatus, but not of a nature seriously to interrupt the continuity of the telegraphic communication. The line to which his instrument was attached was enabled by it to remain in operation during the storm, while in all the others it became necessary to detach the wires in order to prevent injury to the magnets.

At the request of the Institute, Mr. Reid promised, for the Journal, a full description of this interesting and useful invention.

Mr. Coggins described the mode of manufacturing a material for fuel in locomotive engines at Reading in Pennsylvania. This article is composed of fine or pulverized anthracite coal, cemented into a mass by bitumen previously reduced to a fluid state by heat. When these ingredients have been well mixed, the mass is pressed in moulds of a convenient shape and size, retaining, afterwards, a sufficient degree of solidity. The combustion of this fuel he described as being very lively, and resembling that produced from pine knots, giving forth much flame and being, apparently, well adapted for locomotives. The cost of this prepared fuel was not stated.

Mr. G. W. Smith read a letter from Caleb Newbold, jr., President of the Chesapeake and Delaware Canal Co., accompanied by a 4 inch iron spike which had been tinned to prevent oxidation. This spike, Mr. N. says, was inserted between two stones in the wall of the Ches. and Del. Canal, beneath the surface of the water, in which situation it remained during 18 months. At the end of this period the spike was taken up, and was found to be much corroded, the coating of tin having almost entirely disappeared. The laminæ of the iron were distinctly visible, owing to the unequal degree of oxidation resulting from their different qualities; the surface of the spike having lost its original smoothness, and presenting a series of small grooves or striæ, in a longitudinal direction on the body of the spike, and on its head, radiating from the centre. The corrosion was greatest on that part of the spike which projected into the water;—about half its length, which had been inserted between the stones of the wall, being less corroded than the projecting portion.

Mr. Towne read a letter from Capt. Robinson of the U. S. Steamer W. L. Marcy, relative to incrustations formed in the boilers of that vessel on her voyage from Philadelphia to Brazos St. Iago. Specimens of the incrustation *(sulphate of lime)* were exhibited, which were about an eighth of an inch in thickness, having a fibrous crystalline structure, the fibres running in a direction perpendicular to the surface of the boiler. The color of the cross fracture is a glistening pearly white.

Capt. Robinson says, "The entire inside surface of the boiler was thickly encrusted with this substance, which is said to accumulate while the vessel is near the Bahama banks. Its adherence to the inner surface of the boiler was so great that the usual methods of cleaning were found to fail, and it became necessary to have recourse to scrapers of a peculiar construction, made for the occasion. The steamer Marcy was on the banks only about sixteen hours, during which time this substance was deposited on the boilers. The boilers were blown off every thirty minutes during the entire passage."

He further observes, "An English engineer at Key West, who has been long employed in the British government steamers on the West India station, informed me that he had found great difficulty in keeping his boilers from burning, and, in consequence, was careful to keep as far from these banks as possible; but found that by introducing a small portion of ammonia into his boilers, it effectually prevented all substances of any description from forming—keeping them, at all times, perfectly clean."

MECHANICS, PHYSICS, AND CHEMISTRY.

On the Production of Light by Heat. By John William Draper, *M. D., Professor of Chemistry in the University of New York.*

Continued from Page 123.

I proceed now to the third branch of the inquiry,—to examine the relation between the temperatures of self-luminous bodies and the intensity of the light they emit, premising it with the following considerations.

The close analogy which is traced between the phenomena of light and radiant heat lends countenance to the supposition, that the law which regulates the escape of caloric from a body will also determine its rate of emission of light. Sir Isaac Newton supposed that whilst the temperature of a body rose in arithmetical progression, the amount of heat escaping from it increased in a geometrical progression. The fallacy of this was subsequently shown, by Martin, Erxleben, and Delaroche; and finally Dulong and Petit gave the true law, "When a body cools *in vacuo,* surrounded by a medium whose temperature is constant, the velocity of cooling for excess of temperature in arithmetical progression increases as the terms of a geometrical progression, diminished by a constant quantity." The introduction of this constant depends on the operation of the theory of exchanges of heat; for a body, when cooling under the circumstances here given, is simultaneously receiving back a constant amount of heat from the medium of constant temperature.

Whilst Newton's law represents the rate of cooling of bodies, and therefore the quantities of heat they emit, when the range of temperature is limited, and the law of Dulong and Petit holds to a wider extent, there are in our inquiry certain circumstances to be taken into account not contemplated by those philosophers. Dulong and Petit throughout their memoir regard radiant heat as a homogeneous agent, and look upon the theory of exchanges, which is indeed their starting-point and guide, as a very simple affair. But the progress of this department of knowledge since their times has shown, that precisely the same modifications as are found in the colors of light, occur also for heat; a fact conveniently designated by the phrase, "ideal coloration of heat;" and further, that the color of the heat emitted depends upon the temperature of the radiating source. It is one thing to investigate the phenomena of the exchanges of heat-rays of the same color, and another when the colors are different. A perfect theory of the exchanges of heat must include the principle of ideal coloration, and, of course, so too must a law of cooling applicable to any temperature.

There is another fact to some extent considered by Dulong and Petit, but not of such weight in their investigations, where the range of temperature was small, as in ours, where it rises as high as nearly 3000° F.; I mean the difference of specific heat of the same body at different temperatures. At the high temperatures considered in this memoir, there cannot be a doubt that the capacity of platinum for heat is far greater than that at a low point. This therefore must control its rate of calorific emission, and probably that for light also.

From these and similar considerations, we should be prepared to discover that as the temperature of an incandescent solid rises, the intensity of the light emitted increases very rapidly.

I pass now to the experimental proofs which substantiate the foregoing reasoning.

The apparatus employed as the source of the light and measure of the temperature was the same as in the preceding experiments,—a strip of platinum, brought to a known temperature by the passage of a voltaic current of the proper force, and connected with an index which measured its expansion.

The principle upon which I have determined the intensities of the light is that first described by Bouguer, and recently introduced by M. Masson. After many experiments I have been led to conclude that this is the most accurate method known.

Any one who will endeavor to determine the intensities of lights by Rumford's method of contrasting shadows, or by that of equally illuminated surfaces, will find, when every precaution has been used, that the results of repeated experiments do not accord. There is moreover the great defect, that where the lights differ in color it is impossible to obtain reliable measures, except by resorting to such contrivances as that described by me.*

Bouguer's principle is far more exact; and where the lights differ in color, that difference actually tends to make the result more perfect. As it is not generally known, I will indicate the nature of it briefly.

Let there be placed at a certain distance from a screen of white paper, a candle so arranged as to throw the shadow of a ruler, or other opaque body, on the screen. If a second candle be placed also in front of the paper and nearer than the former, there is a certain distance at which its light completely obliterates all traces of the shadow. This distance is readily found; for the disappearance of the shadow can be determined with considerable exactness. When the lights are equal, Bouguer found that the relative distances were as 1 :8; he inferred therefore, correctly, that in the case of his eye, the effect of a given light was imperceptible when it was in presence of another sixty-four times as intense. The precise number differs according to the sensibility of different eyes, but for the same organ it is constant.

Upon a paper screen I threw the shadow of a piece of copper, which intercepted the rays of the incandescent platinum: then taking an Argand lamp, surrounded by a cylindrical metal shade through an aperture in which the light passed, and the flame of which I had found by previous trial would continue for an hour almost of the same intensity, I approached it to the paper until the shadow cast by the copper disappeared. The distance at which this took place was then measured, and the temperature of the platinum determined.

The temperature of the platinum was now raised; the shadow became more intense, and it was necessary to bring the Argand lamp nearer before it was effaced. When this took place the distance of the lamp was again measured, and the temperature of the platinum again determined.

Table of the Intensity of Light emitted by Platinum at different Temperatures.

Temperature of the platinum.	Distance of Argand Lam		Mean.	Intensity of Light.
	Experiment 1.	Experiment 2.		
°				
980	......	....	......	0·00
1900	54·00	54·00	54·00	0·34
2015	39·00	41·00	40·00	0·62
2130	24·00	24·00	24·00	1·73
2245	18·00	19·00	18·50	2·92
2360	14·50	15·50	15·00	4·40
2475	11·50	12·00	11·75	7·24
2590	9·00	9·00	9·00	12·34

In this manner I obtained several series of results, one of which is given in the foregoing table. They exhibited a more perfect accordance among each other than I had anticipated. The intensity of the light of the platinum is of course inversely proportional to the square of the distance of the Argand lamp at the moment of the obliteration of the shadow.

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* Phil. Mag., August, 1844.

In this table the first column gives the temperatures under examination in Fahrenheit degrees: the second and third, the distances of the Argand lamp from the screen, in English inches, in two different sets of experiments; the fourth, the mean of the two; and the fifth, the corresponding intensity of the light.

From this it is at once perceived, that the increases in the intensity of the light, though slow at first, become very rapid as the temperature rises. *At* 2590° *the brilliancy is more than thirty-six times as great as it is at* 1900°.

Thus, therefore, the theoretical anticipation which we founded on the analogy of light and heat is completely verified; and we discover that as the temperature of a self-luminous solid rises, it emits light in a greater proportion than would correspond to the mere difference of temperature. To place that analogy in a still more striking point of view, I will here introduce some experiments I have made in relation to radiant heat. No Chemist, so far as I am aware, has hitherto published results for high temperatures, or endeavored to establish, through an extensive scale, the principle of Delaroche, that "the quantity of heat which a hot body gives off in a given time by way of radiation to a cold body, situated at a distance, increases, other things being equal, in a progression more rapid than the excess of the temperature of the first above that of the second."

As my object on the present occasion is chiefly to illustrate the remarkable analogy between light and heat, the experiments now to be related were arranged so as to resemble the foregoing; that is to say, as in determining the intensities of light emitted by a shining body at different temperatures, I had received the rays upon a screen placed at an invariable distance, and then determined their value by photometric methods; so, in this case, I received the rays of heat upon a screen placed at an invariable distance, and determined their intensity by thermometric methods. In this instance the screen employed was in fact the blackened surface of the thermo-electric pile. It was placed at a distance of about one inch from the slip of incandescent platinum, a distance sufficient to keep it from any disturbance from the stream of hot air arising from the metal: care also was taken that the multiplier itself was placed so far from the rest of the apparatus, that its astatic needles could not be affected by the voltaic current igniting the platinum or the electro-magnetic action of the wires used to modify the degrees of heat.

The experiments were conducted as follows:—the needles of the thermo-multiplier standing at the zero of their scale, the voltaic current was passed through the platinum, which immediately rose to the corresponding temperature, and radiated its heat to the face of the pile. The instant the current passed, the needles of the multiplier moved, and kept steadily advancing upon the scale. At the close of one minute, the deviation of the needle and the temperature of the platinum were simultaneously noted, and then the voltaic current was stopped.

Sufficient time was now given for the needle of the multiplier to come back to zero. This time varied in the different cases, according to the intensity of the heat to which the pile had been exposed : in no instance, however, did it exceed six minutes, and in most cases was much less. A little consideration will show that the usual artifice employed to drive the needles back to zero, by warming the opposite face of the pile, was not admissible in these experiments.

The needles having regained their zero, the platinum was brought again to a given temperature, and the experiment conducted as before. The following table exhibits a series of these results.

Table of the Intensity of Radiant Heat emitted by Platinum at different Temperatures.

Temperature of the Platinum.	Intensity of heat emitted.		Mean.
	Experiment 1.	Experiment 2.	
°			
980	·75	1·00	·87
1095	1·00	1·20	1·10
1210	1·40	1·60	1·50
1325	1·60	2·00	1·80
1440	2·20	2·20	2·20
1555	2·75	2·85	2·80
1670	3·65	3·75	3·70
1785	5·00	5·00	5·00
1900	6·70	6·90	6·80
2015	8·60	8·60	8·60
2130	10·00	10·00	10·00
2245	12·50	12·50	12·50
2360	15·50	15·50	15·50

In this table the first column gives the temperatures of the platinum in Fahrenheit degrees ; the second and third, two sets of experiments, expressing the arc passed over by the needle at the close of a radiation lasting for one minute, each number being the mean of several successive trials ; and the fourth, the mean of the two. It therefore gives the radiant effect of the incandescent platinum upon the thermo-multiplier for the different temperatures.

Of course it is understood that I here take the angular deviations of the needle as expressing the force of the thermo-electric current, or, in other words, as being proportional to the temperatures. This hypothesis, it is known, is admissible.

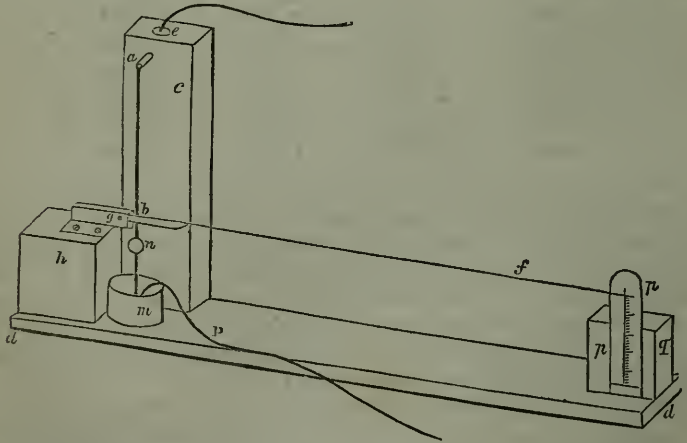
It therefore appears that the quantity of heat radiated by incandescent platinum, at 980° being taken as unity, it will have increased at 1440° to 2·5 ; at 1900° to 7·8; and at 2360° to 17·8, nearly : the rate of increase is therefore very rapid. Further, it may be remarked, as illustrative of the same fact, that the increased quantity of heat radiated by a mass of platinum in passing from 1000° to 1300°, is nearly equal to the amount it gives out in passing from common temperatures up to 1000°.

I cannot here express myself with too much emphasis on the remarkable analogy between light and heat which these experiments reveal. The march of the phenomena in all their leading points is the same in both cases. The rapid increase of effect as the temperature rises is common to both.

It is not to be forgotten, however, that in the case of light we necessarily measure its effects by an apparatus which possesses special peculiarities. The eye is insensible to rays which are not comprehended within certain limits of refrangibility. In these experiments, it is requisite to raise the temperature of the platinum almost to 1000° before we can discover the first traces of light. Measures obtained under such circumstances are dependent on the physiological action of the visual organ itself, and hence their analogy with those obtained by the thermometer becomes more striking, because we should scarcely have anticipated that it could be so complete.

Description of the apparatus employed in the foregoing experiments.

The source of light is in all instances a slip of platinum foil 1·35 inch long, and $\frac{1}{20}$th of an inch broad, ignited by the passage of a voltaic current, and placed in such a position that its dilatation could be measured by the movements of an index over a graduated scale.



In the figure, *a b* represents the slip of platinum, the upper end of which is soldered to a stout and short copper pin *a*, firmly sunk in a block of wood *c*, which is immovably fastened on the basis *d d* of the instrument. A cavity *e*, half an inch in diameter, is sunk in the block *c*, and into this cavity the pin *a* projects; so that when the cavity is filled with mercury, a voltaic current may be passed through the pin and down the platinum.

The other extremity of the platinum *b* is fastened to a delicate lever *b f*, which plays on an axis at *g*, the axis working in brass holes supported on a block *h*. Immediately beneath the platinum strip, and in metallic communication with it, a straight copper wire dips down into the mercury cup *m*; on this wire there is a metal ball *n*, weighing about 100 grains. The further end of the index plays over a graduated ivory scale *p p*, which is supported on a block *g*, and can be moved a little up and down, so as to bring its zero to coincide with the index at common temperatures.

The action of the instrument is readily understood. In the mercury cup *e* dip one of the wires N of a Grove's battery of three or four pairs, the other wire P being dipped into the cup *m*. The current passes through the platinum, which immediately expands, the weight *n* lightly stretching it. The index *f* moves promptly over the scale, indicating the amount of expansion, and therefore the degree of heat. Remove the wire N out of its mercury cup *e*, the platinum instantly becomes cold, and pulls the lever to the zero point.

When the platinum is thin, so as to be quite flexible at the point *b*, where it is fastened to the index, the movements take place with such promptitude and precision as to leave nothing to be desired. When the heat has been very high and long continued, the limit of elasticity of the platinum is somewhat overpassed, and it suffers a slight permanent extension. But as the ivory scale *p p* can slide up and down a little, the index is readily re-adjusted to the zero point.

The temperature of the platinum depends entirely on the force of the current passed through it. By intervening coils of brass wire of lengths adjusted beforehand, so as to resist the current to a given extent, any desired temperature may be reached. I found it convenient to intervene in the course of the current one of Prof. Wheatstone's rheostats, so as to be able to bring the index with precision to any degree, notwithstanding slight changes in the force of the voltaic battery.

The following are the dimensions and measures of the instrument I have used:—Length of the platinum strip, 1·35 inch; length of the part actually ignited, 1·14 inch; width of ditto, $\frac{1}{20}$th of an inch; length of the index from its centre of motion to the scale, 7·19 inches; distance of the centre of motion of index from the insertion of the platinum at the point *b*, ·22 inch; multiplying effect of the index, 32·68 times; length of each division on the ivory scale, ·021 inch. From this it would appear, by a simple calculation, using the coefficient of dilatation of platinum given by Dulong and Petit, that each of the divisions here used is equal to 114·5 Fahrenheit degrees. For the sake of perspicuity I have generally taken them at 115°.

The Grove's battery I have employed has platinum plates three inches long and three quarters wide; the zinc cylinders are two inches and a half in diameter, three high, and one-third thick. As used in these experiments, it could maintain a current nearly uniform for an hour. I commonly employed four pairs.

On the Gauges at present used, for measuring the thicknesses of sheet metals and wires, and proposals for a new system of Gauges, founded on the decimal subdivision of the Standard Inch. By Mr. Holtzapffel.

(Continued from page 310.)

The remedy proposed to remove the arbitrary incongruous system of gauges now used, is simply and in every one of the cases referred to, and also in all others requiring minute measures, to employ the decimal divisions of the inch, and those under their true appellation.

Thus for most purposes the division of the inch into one hundred parts would be sufficiently minute, and the measures 1. 2. 5. 10. 15. or 100 hundredths, would be also sufficiently impressive to the mind; their quantities might be written down as 1. 2. 5. 10. 15 or 100 hundredths, as the decimal mode of expression might, if preferred, be safely abandoned, and the method would be abundantly distinct for common use if the word "Hundredths" were stamped upon the gauge, to show that numerals denoted hundredths of the inch, quantities which could be easily verified by all.

It does not follow that the entire hundred notches should be at all times used, as in many cases it might suffice that below 20 hundredths, every size should be employed:—from 20 to 50 hundredths, every alternate size, from 50 to 100 hundredths every fifth size. As at present also, the upper or lower part of the series of terms might be omitted to any desired extent, in those cases where they were beyond the particular wants of the artizan or the particular branch of trade, in order to lessen the bulk and expense of the gauge.

It may be objected to this scheme, that for the more valuable metals, and the more minute purposes, the quantity of the one hundredth of an inch is too coarse a difference. Two facile modes of remedy may be here applied. The first to make half sizes; thus 8½ or 8·5 would of course denote the medial interval between 8 and 9 hundredths. Or secondly, and preferably, below one-tenth of an inch, a finer scale might be substituted for the more minute and delicate purposes, namely, a gauge based in precisely the same manner, on the *thousandth* of the inch as the unit, which would give a much finer degree of subdivision than is afforded by any of the arbitrary gauges in general use; in this case the intervals being derived from the thousandth of an inch, the word "Thousandths" should be stamped on every such gauge.

In practice no difficulty could be seriously felt even without this precaution of marking the gauges respectively with the word hundredths or thousandths; as we should not more readily mistake 5 thousandths for 5 hundredths, than we should 5 tenths or half an inch, for 5 whole inches, or 5 entire inches for as many feet.

Neither is it to be admitted that no such gauges are attainable as may be read off in hundredths or thousandths. The demand would immediately create the supply, and there could be no more difficulty in constructing the gauges of the customary forms, with notches made to systematic and *defined* measures that may be easily arrived at or tested, than with their present unsystematic and *arbitrary* measures, which do not admit of verification.

Besides, for those who desire to possess them, several very correct decimal gauges already exist, amongst which may be cited the decimal sector gauges long since recommended, and published by the Society of Arts, Edinburgh, and various sliding gauges with verniers, some to read off in hundredths, and finer ones in thousandths, of the inch, all of which have been long and constantly used in the author's manufactory.

To these may be added, La Rivière's gauge, modified and enlarged from that used for the balance springs of watches amongst the Geneva watchmakers—Chater and Haywood's gauge for sheet metals and glass—Walker's gauge for sheet iron—Whitworth's micrometer gauge, and others, which may be severally read off to the thousandth of the inch, and even more minute quantities, and amongst which kinds sufficient choice exists for almost every purpose.

The advantages offered by this proposed application of decimal measures, appear to be numerous and considerable, the more especially in those cases of small measures, where the ordinary wire gauges on the one hand, and the coarse division of ordinary foot rules on the other, are obviously insufficient for accurate purposes. Amongst these advantages may be enumerated the following:—

The proposed decimal scheme would introduce one universality of system, intelligible alike to all, instead of the numerous and irregular measures now used, which are but partially and indifferently known and lead to frequent mistakes.

It would give a superior idea of particular magnitude, and enable the theoretical and practical man to proceed with so much more decision in their respective communications.

In conveying verbal or written instructions, the system would be in every way superior to the usual methods, as being almost free from the chance of misunderstanding; more especially as some of the decimal sliding gauges are so small as hardly to take up more room in the pocket than an ordinary penknife, and might be therefore continually within reach for reference.

When certain objects are required to be so proportioned as to constitute a series; the intervals between the decimal measures would be far more easily arranged and appreciated, than those of vulgar fractions; and if calculation were referred to, the decimal figures, especially when divested of the decimal point, and the zeros to the right of the same, would be immediately intelligible to the least informed, from being then no more in fact than simple numerals.

Quantities expressed decimally would be more easily written down and more exactly defined, than the compound fractions, such as $\frac{3}{8}$ and $\frac{1}{16}$ of an inch—or than the still more obscure method, of $\frac{3}{8}$ of an inch *full* or *bare* as the case might be, which latter nearly sets all attempt at exactness at defiance.

The smaller aliquot fractions of the inch, such as the $\frac{1}{20}$, $\frac{1}{22}$, $\frac{1}{24}$, $\frac{1}{26}$, $\frac{1}{28}$, $\frac{1}{30}$, &c., of an inch, although in themselves very precise, do not from their nature, so readily admit of definition or comparison, as the quantities 2, 3, 4, 5, 6, 7, 8, 9, or 10 hundredths of an inch; because, in the vulgar fractions every one has a *specific* relation to the inch, whereas the decimal terms have one *general* relation, decimals being sometimes considered as the numerators of fractions, all having the constant denominator, unity, or 100, 1000, &c.; and therefore the latter, or the decimal terms, constitute a simple arithmetical series, or one in which the intervals are alike, but this is not the case with vulgar fractions.

It would bring all foreign measures within reach of our workshops. For example, in the United States of America and Russia, English measure is employed, and no difficulty would be felt in reference to those countries. And as most of the National Foot measures are more than 11 inches English, and less than 13, even if they are considered for the time as equal to our own foot, and without any adjustment being attempted, the average error would not exceed about five per cent. And further, when two of Holtzapffell and Co's engine-divided scales, the one of the particular foreign measure, and the other of English inches, are laid side by side, they show visually, as on a slide rule, the correspondence between any quantity of such foreign measure with our own, as more fully explained in the author's pamphlet "On a New System of Scales of Equal Parts," in which this and numerous other employments of scales of equal parts are treated at length.

The decimal scheme would allow the exact weight in every superficial foot of sheet metals and other substances to be readily arrived at. Thus, as a cubic foot of water weighs 1000 ounces troy, the specific gravities of lead, copper, silver, &c., denote at the same time how many troy ounces are severally contained in one cubic foot of the same. The specific gravity divided by 1200, gives the weight of a plate or film, the one hundredth of an inch thick, and thence a table may be readily computed, by addition alone, to show the weight of plates of any thickness in troy ounces.

These calculations would be correct at once for gold and silver, as these metals are estimated by troy weight; but for other substances requiring avoirdupois weight, the numbers expressing the specific gravities of the substances must be previously altered by one of the usual methods, namely, either by multiplying them by 192, and dividing the product by 175, numbers which represent the ratio between troy and avoirdupois ounces; or else instead thereof, the specific gravities of substances may be multiplied by the decimal constant usually employed for effecting the same end.

In this method, also, constant multipliers may be readily found, for thus determining, from the specific gravities of the several materials, the exact thickness of plates or sheets of the same, which shall precisely weigh one ounce or one pound, either troy or avoirdupois, as may be required. This has already been done by Mr. Hayward, as regards crown glass; for, assuming its specific gravity to be 2·52, when the glass is of the thickness of ·1525, (or one-tenth and a half, nearly,) it weighs 32 avoirdupois ounces to the superficial foot, and thence, by Mr. Hayward's calculation, are obtained the following numbers,—the first line denotes the weight of crown glass in ounces, in every superficial foot, the second line the corresponding thickness in thousandths of the inch, ranging from about 5 to 152 thousandths:—

Crown glass of	1,	2,	4,	8,	12,	16,	20,	24,	28,	32 ounces.
Measures	·00476,	·0095,	·019,	·038,	·0571,	·0762,	·0952,	·1333,	·1429,	·1524 inch.

The above and the intermediate terms are sometimes engraved on Messrs. Chater & Haywood's gauges, alongside of the line of gradations which denotes thousandths; and at other times, instead of the weight per foot, are engraved divisions, indicative of the 8th, 9th, 10th, 11th, 12th, &c., of the inch; which quantities are of course obtained by simply dividing 1000 by those respective numbers.

Tables might, in the above manner, be very readily computed that would show the weights in every superficial foot of the metals and other materials for all defined thicknesses; and, also, other tables, for showing how thick the metals should be, in order to weigh exactly so many ounces to the superficial foot. These matters could be also arrived at, by the employment of scales of equal parts, laid down in the proportions of the specific gravities of the substances; and, in the opinion of the author, they could be worked out with even greater simplicity and universality, by a decimal proportional instrument he has some time since contrived, which is applicable to the visual development of all ratios that have reference to all decimal arithmetic, including those of interest, discount, profit, and other calculations to which the term per cent. is applied.

In conclusion, the author begs to add, that he does not suggest any alteration whatever, as regards those measures for which the division of the foot-rule, into eighths and sixteenths, may be found sufficiently precise and minute. But he would ask, whether, for more minute measurements, greater convenience and distinctiveness would not result, from the general employment of measures expressed in hundredths of the inch, than from the employment of the many gauges for specific uses, the sizes and numbers of which are entirely devoid of system, and which gauges may be considered as unknown beyond the particular trades in which they are employed.

How confusing would it be, if the measures by which broad cloths, linens, cottons, silks, velvets, carpets, and other textile fabrics, are manufactured and sold, were all different, instead of being uniformly the yard measure; and yet this incongruity fully applies to the various articles, whose measurements are described under the mystical names of Number, Size, Gauge, and other appellations, which assume different values in different branches of manufacturing art; as, for example, in the various kinds of sheet metals, various kinds of wires, in tubes, joiners' screws, and vast numbers of small manufactured articles, the various sizes of which are arbitrarily designated as Nos. 1, 2, 3, 4, &c.

Why not, in all these branches of trade, describe every thing measuring $\frac{1}{10}$th of an inch, as No. 10; those of $\frac{3}{10}$ths of an inch, as No. 30? and then, in sets of objects required to be nearly alike, the succeeding numbers could be 31. 32. 33. 34. 35. 36. &c; or, if fewer and wider variations were wanted, the series might be 32. 34. 36. 38. 40.; or else 35. 40. 45. 50. 55. Every trade could select any portion of the series it might require, both as regards general magnitude, and the greater or less intervals between the sizes, and with the power of adding to, or subtracting from, the scale first selected, as circumstances might suggest.

But there should be one common understanding, that the commercial numbers or sizes, when different from the measures of the foot-rule, should always be understood to be hundredths of the inch, (in some rare instances thousandths,) as then, from the unity of system, no confusion or difficulty could possibly arise.

It may be true, that some of the proposals, having reference to the weights of materials in the superficial foot, the correspondence with foreign measures, and some of the projects principally intended for the purposes of science, may not be required in everyday practice; but still much remains in the system, that, in the opinion of the author, would admit of very easy introduction, and most general and satisfactory employment.

In respect to the practical application of the method of decimal divisions, as regards mechanical construction, the author can speak most satisfactorily, from some years' experience in his own manufactory, as he has found it to be most readily followed by his work-people, and also, that it has avoided frequent and vexatious misunderstandings, to which, before its adoption, he was frequently subjected, from the want of a more minute and specific system of measure, than is afforded by the common foot-rule and wire gauges.

Therefore, from conviction of the usefulness and practicability of the decimal system of measures for small quantities, he would most strongly urge its general, or, indeed, universal, adoption, as above proposed; the more especially, as it is a change that would be attended with very little temporary inconvenience or expense—circumstances which greatly retard all attempts at generalization.

Glasgow Prac. Mech. & Eng. Mag.

On Nitric Mannite. *By* M. Sobrero.

Translated for the Journal of the Franklin Institute.

Since the re-action of nitric acid upon organic substances has occupied the attention of chymists, a number of bodies have been discovered which are very interesting in a scientific point of view; but of these the arts have only for their share gun cotton, of which the ultimate fate is still very uncertain. While the question with regard to this cotton is being determined, I announce to the Academy that another substance, possessing fulminating properties in the highest degree, is furnished by the re-action of nitric acid upon *mannite*,—the nitric mannite of which Messrs. Flores Domonte and Menard have already given the composition.

The fulminating mannite has the property of exploding under the blow of a hammer, with the same violence as the fulminate of mercury; and produces, in its decomposition, the heat necessary for exploding gunpowder. As soon as I was acquainted with this property, I proceeded to its application, and myself prepared some capsules in which I placed a small portion of the nitric mannite, crystallized in alcohol. With these I primed a fowling piece, and discharged it, in the same manner as if ordinary percussion caps had been used. It is hoped that more extended experiments will be made in order to determine the most convenient mode of substituting this material for fulminating mercury; but, from the present, I think certain propositions regarding it may be considered as established:

1. That the fulminating mannite will be always cheaper than fulminating mercury.
2. That it is more easily prepared, and that in its manufacture the workmen are not exposed to the serious dangers to which those are liable who prepare the ordinary fulminating powders.

It should be cheaper than fulminating mercury, because the price of manna is moderate;—because the preparation of mannite furnishes as residuum the uncrystallizable material, mixed with a little mannite, which may be still employed in medicine and for veterinary purposes as a purgative;—and because, according to the analysis of Messrs. F. Domonte and Menard, mannite by its conversion into nitric mannite, has its weight very considerably increased (from 100 to 225.)

In its preparation and manipulation it is less dangerous:—indeed the preparation is only accompanied by the disengagement of some vapor of nitric acid. The fulminating mannite explodes only by a violent blow, between two hard bodies; heat gradually applied will cause it to melt, and afterwards decompose it, but without explosion. It may, indeed, be placed upon a piece of paper, and touched with a burning coal, when it will melt without detonating. Or the paper upon which it is placed may be burned and the substance thus decomposed without exploding.

The fulminating mannite is decomposed beneath the stroke of a hammer without leaving a residuum, and, as it appears, without producing nitrous vapors. It seems to be completely resolved into carbonic acid, water, and azote. And, finally, it may be kept, for an indefinite length of time, without decomposition.

Comptes Rendus, July, 1847.

Observations upon Silica. *By* M. Doveri, of Florence.

Translated for the Journal of the Franklin Institute.

It appears, from the observations contained in the memoir submitted by this author:

1. That the alkaline silicates, decomposed by acids, and particularly by hydrochloric acid, deposit the greatest part of the silica which they contain when the acid is added drop by drop, in excess; while if

the same quantity of acid be added at once, not the smallest quantity of silica is precipitated.

2. That the silica, having been once precipitated, is not re-dissolvable in the acids, whatever may have been its origin, whether precipitated from an alkaline silicate by an acid, or from fluoride of silicium by means of water.

3. That the weaker acids, such as carbonic, sulphurous, boracic and the vegetable acids, decompose the alkaline silicates at ordinary temperatures, and precipitate the silica either in white powder or gelatinous flakes.

4. That the silica in a state of minute division, either anhydrous or hydrated, is capable of decomposing the alkaline carbonates in solution in water, at the boiling point, dissolving in the fluid.

5. That the silica precipitated at the ordinary temperature, from a solution of an alkaline silicate or the fluoride of silicium, is a hydrate of definite proportions, of which the composition may be expressed by the formula $HO, Si\,O^3$; that this hydrate, at the temperature of 100°, loses one equivalent of water, and is changed into another, composed $HO, 2Si\,O^2$.

6. That when a solution of an alkaline silicate is treated by a metallic solution, there results a precipitate consisting of a mixture of hydrated silica and metallic silicate:—that the metallic silicate is entirely dissolved by the mineral acids, while the free silica remains undissolved.

7. That a limpid solution, highly charged with silica in hydrochloric acid, may be obtained by dissolving in that acid the silicate of copper, and precipitating the copper by sulphuretted hydrogen.

8. That the solution of silica in hydrochloric acid, evaporated slowly under an air pump, yields hydrated silica ($HO, Si\,O^2$) perfectly crystallized in very slender and transparent acicular crystals, grouped together in stars or tufts. Ibid.

Experiments upon the Crystallization of Carbon. By M. CAGNIARD LATOUR.

Translated for the Journal of the Franklin Institute.

More than ten years ago, I presented some diamonds to several members of the Academy of Sciences, informing them at the time that these diamonds had been produced by means of a process invented by me, because I then believed it. As I now acknowledge that I was mistaken, I consider it a duty to declare it to the Academy.

The only somewhat remarkable substances that I obtained in my own experiments upon the crystallization of carbon, were microscopical laminæ or scales, of a circular form, very thin, transparent, and colorless, the largest of which were hardly the twenty-fifth part of a millimetre in diameter.

Their production being difficult, I have not yet been able to obtain a quantity sufficient to enable me to determine their composition; but it nevertheless seems allowable to consider them as having some analogy with the diamond, inasmuch as in the divers experiments which, with the aid of the microscope, I have made upon these laminæ, and of which the number was about 160, the general results were as follows: 1. The hydrate of potassa in fusion has no action upon them at a temperature in which this alkali acts briskly upon silica. 2. They are sufficiently hard to scratch glass. 3. They entirely disappear when brought to a red heat in the open air.

These scales were produced in the two experiments of which I have given the details in a memoir which I have this day had the honor to submit to the Academy. Ibid.

The Difference which Exists between Gilding by Mercury and Electro-Gilding. By M. Barral.

The author of this paper says that he has been frequently called upon to solve the following question, viz.:—"By what means had a certain article of copper or silver been gilded?" This could not possibly be ascertained with certainty by mere inspection, even by the most experienced eye. M. Barral has, however, discovered a certain means of ascertaining the fact by chemical reaction. He has found that by attacking the articles to be tested with dilute nitric acid, either warm or cold, pellicles of gold are obtained, of the exact form of the article; provided the acid be not allowed to act too energetically. These pellicles are of a yellow gold color on both sides, when obtained from articles gilt by simple immersion in an alkaline solution of gold, or by means of the galvanic current decomposing certain solutions. On the contrary, the pellicles produced on the surfaces of articles gilt by mercury are of a reddish-brown color on the side next the surface of the articles gilt.

In order to explain this difference in the appearance of the pellicles of gold, M. Barral first had certain articles gilt by the mercury process with certain quantities of gold. The articles thus gilt, on being acted upon by dilute nitric acid, furnished pellicles of gold of a deep brown color on their inner faces, and heavier than the gold originally employed in the gilding process. The pellicles not dissolved by the acid were therefore not pure gold.—They were proved by direct analysis to contain about three per cent. of copper or silver, according to which of these two substances the gilt article was formed.

M. Barral therefore considers it evident that when the amalgam of gold is applied to the surface of an article, a double amalgam of gold and copper or silver is formed. If the article be then submitted to heat, the mercury will be volatilized, and an alloy will be formed, thereby uniting the precious metal and the metal of which the article is formed. If the article gilt be then acted upon by nitric acid, the metal of which it is formed will be completely dissolved, and the acid will act upon the alloy, and carry off the copper or silver near the inner surface, where the gold is in small quantity. But, as the proportion of gold increases near the outer surface, it will preserve the other metal from dissolution, as is well known to be the case with all alloys in which gold predominates.

It will therefore be understood, that the pellicles detached from articles gilt with mercury must be covered on their inner surface, after being acted on by the nitric acid, with a very thin layer of gold, which gives it a brown color; this will also explain the reason why nitric acid leaves the gold in an impure state after the destruction of the base metal of the articles.

When an article to be tested has been gilt by electro-chemical means, it will be found that the pellicle of gold covers the copper or silver, without amalgamating therewith; and therefore the nitric acid will not act upon the layer of gold.

The foregoing explanation proves the new methods of gilding to be less solid than the old ones; for it is evident that a layer merely laid on like a coat of paint, cannot adhere so tenaciously as when the metals are to a certain extent incorporated. Experience has proved, however, that the processes of electro-gilding and gilding by simple immersion possess certain advantages over the old methods. The pellicle obtained from the gilding by mercury, when held up to the light, presents an appearance of being perforated with numerous fine holes; this effect is produced by the passage of the mercury through the gilding when driven off by evaporation. Layers of gold deposited by a battery or by immersion are, however, perfect coatings; and, consequently, for domestic purposes—especially for vessels intended to come in contact with acids—copper articles, gilt by the mercury process, possess disadvantages which are obviated by the new processes.—*Comptes Rendus.* Lon. Jour. of Arts & Sci.

On the Steam Jet. By Mr. FARADAY.

In Mr. Faraday's former discourse on Mr. Barry's method of warming and ventilating the new House of Lords, he mentioned that a part of the means employed for securing a current of air sufficiently abundant to insure the required object was the use of a jet of high-pressure steam in the ventilating shaft of that building. The present evening Mr. Faraday devoted to a consideration of the physical conditions of such a steam-jet, and to the relations of the vapor discharged from it to the surrounding air. More than forty years ago, Dr. Young (Nat. Phil., vol. ii., p. 534) had shown that, wherever any elastic fluid was forced from a jet with but small velocity, the steam proceeded for some inches without observable dilatation, and then diverged into a cone; but that when the pressure on this vapor was increased, the apex of the cone approached the orifice of the jet; but whatever might be the amount of this pressure, the form of the cone continued the same. Mr. Faraday proceeded to notice the lines of motion of the particles constituting this cone of vapor. The rings of smoke produced by the combustion of bubbles of phosphuretted hydrogen on the surface of water were exhibited. The revolution of each of these hollow rings on the axis of the cylinder which forms it was pointed out, as was their gradual expansion when rising into the air: and it was shown that each of these enlarging rings might be viewed as a magnified element of the cone of steam issuing from the jet. In the same class of effects Mr. Faraday placed the rotating clouds of smoke which are seen issuing from the chimneys of steamboats, &c. The force with which the particles of the air surrounding the cone of steam produced by a powerful jet were drawn towards it, were shown by various striking experiments. Hollow balls of one and two inches diameter were seen drawn into the cone, and sustained floating in the line of its axis, even when, by an arrangement of the apparatus, this axis was brought 35° out of the perpendicular. An upright glass tube, eighteen inches long and one inch diameter, having one extremity plunged into water and the other end drawn into a capillary jet, was visibly exhausted of its contained air (the water being drawn up from the lower end of the tube) when the capillary jet was placed within the in-draught of air occasioned by the cone of steam. In closing this part of his subject, Mr. Faraday explained the use which had been made of a cylindrical, or conical, jacket, to include this steam-cone, and thus to increase the draught-power of the jet. In the arrangement adopted by Mr. Barry for ventilating the House of Lords, this jacket is the ventilating-shaft itself; so that there can be no room for the entrance of air to form a downward current in the shaft. This mode of moving air has been adopted in lead-works and other manufactories, for the purpose of washing and condensing the smoke where noxious fumes are generated in the processes. Noticing the coolness of the high-pressure steam, even near the orifice of the jet, as being due to the quantity of cold air rushing towards it and diminishing its temperature, Mr. Faraday connected with this and the other phenomena the experiment of M. Clement Désormes—who showed that when steam, under high-pressure, is allowed to escape from an orifice pierced in a plate, and a flat disc is brought close to this plate, the plate and disc are made to adhere together. In this case, the elastic force of the steam issuing from the jet, and which tends to separate the plate and disc, diminishes rapidly in its course from the centre to the edges of the disc; at the same time, the radial currents, by their indraught, as before illustrated, bring the two plates together with a power which is so much greater than the former that the surfaces adhere. Mr. Faraday finished by noticing the danger of conical safety-valves in high-pressure boilers, when the lateral expansion of the conical surface is large in proportion to the sectional area of the steam passage.—*Proceed. Royal Inst.*

London Athenæum.

An account of the Iron Barque Josephine, of Liverpool. By CAPT. MASTERS, *who commanded her in the voyages she has made.*

The subject of iron vessels is one of great importance, and the use of that material in naval architecture has been steadily progressing since it was introduced for sea-going vessels by Mr. Manby, in the steamer named after him, in 1821, and which was the only vessel that ever conveyed a cargo direct between London and Paris, without transhipment. Sanguine hopes had been entertained of introducing iron for vessels of war; but it appears from the partial accounts that have been made public of the results of the experiments at Woolwich and elsewhere, that the effects of cannon-shot upon iron vessels are more destructive than upon timber. The paper read was a plain and somewhat dry specification of the construction of the vessel, which will, however, when printed *in extenso* in the minutes of proceedings, be extremely useful. The main dimensions of the barque *Josephine* are—Length, over all, 99 ft. 3 in.; extreme breadth, 24 ft. 6 in.; depth of hold, 9 ft. 9 in.; register tonnage, 168 tons; by old measurement, 221 tons. She was of a peculiar build, differing from almost any other merchant-ship, being intended for service in the Mexican trade, and calculated to cross the bar of Tampico, and other impediments. She was entirely of iron, even to the bulwarks; and as she lay low in the water, drawing 9 ft. aft, and 8 ft. 8 in. forward, her ports were hung on hinges forward, so that they should act as valves, and allow the water to escape from the deck, and yet shut of themselves when she heeled over deep on her side. Her general rate of sailing was from 11½ to 12 knots per hour; she was very buoyant and very dry, rising well to the sea. There was great capacity for stowing the cargo, owing to the absence of large projecting timbers. She was somewhat damp forward and aft, but was very dry in the main hold. There was not found to be any difference in the health of the crew from that of wooden vessels; she was a little cooler than other ships, owing to her being so deep in the water, and the thin material did not retain the heat like wood. Iron ships have generally been found to get very foul: the *Josephine* was, however, paid with various compositions as experiments. That which succeeded best was—1 barrel of varnish, 2¾ cwts. of best tallow, 40 lbs. black lead, 7 lbs. brimstone, and 70 lbs. arsenic. This being applied hot, the iron having been previously warmed and paid with boiled linseed oil, appeared to have prevented foulness, as after her voyages there was little weed or grass, and scarcely any barnacles; but very slight oxidation took place, and that only where the composition had been rubbed off. They were as much annoyed by rats as in a timber ship, nor could they be destroyed by any of the means adopted. The principal feature of the paper was that which treated of the local attraction of the compass, which can scarcely be given in an abridged form. It appeared that as long as the ship was on an even keel, and perfectly upright, the compass acted correctly, but in proportion to the listing over so was the derangement of the magnet, the local attraction being changed by the side frames and deck-beams falling into new positions. This caused great variation in the ship's course, and it led to conjecture whether this may not have been the cause of the loss of the *Great Britain*—as if her compasses were acted upon as much as those of the *Josephine*, a deviation of 6½ miles from her course might easily have occurred. Capt. Masters suggested the hanging the binnacles complete in gimbles like the compass, in order to their always remaining vertical, and also in adjusting the compasses, that they should be tried in every position, a table of variation being made out for every degree of listing over. The paper was illustrated by drawings of the vessel and of her rigging which possessed peculiarities, and also by several tables for the correction of the compasses.—*Proceed. Inst. Civ. Eng.* Min. Jour.

On the Law which Governs the Discharge of Elastic Fluids under Pressure, through short Tubes and Orifices. By W. Fronde, M. Inst. C. E.

The subject of the paper admitted of a much longer communication than could be read at one meeting, and the train of reasoning was such as could scarcely be perfectly entered into on merely hearing it read; nor is it possible, within our limits, to give a complete analysis of a paper, which, for accuracy of perception, closeness of reasoning, and terseness of diction, has rarely been equalled in any scientific society. A succinct review of it must suffice. The law proposed was a modification of that which has been usually assumed—viz : a simple application of that which holds good with respect to non-elastic fluids ; this law is, generally, that the velocity of issue is directly as the square root of the pressure, and inversely as the square root of the density : but this law neglects wholly the reaction that must arise from the expansion necessarily taking place in the course of issue. The nature of the action was illustrated by the following example :—If a balance be supposed, with an equal weight in each scale, one of the weights being a spiral spring, like that of a spring balance compressed lengthwise with its axis vertical, and held in a state of compression by a cord. Now let the cord be suddenly reversed, so that the spring is enabled to extend itself vertically ; the scale in which it stands will obviously be depressed, the spring reacting on it as it expands upwards, and continuing to press till wholly relaxed ; or if the scale in which it stands were ascending by a preponderance given to the other scale, the rate of its ascent would be in the same way retarded. The amount of the retardation would depend on the strength and the weight of the spring, and on the length to which it would extend itself when released. Now in the discharge of an elastic fluid, there is an action strictly analogous, operating continuously, however, instead of *per saltum*, the strength and weight of the spring being represented by the elasticity and density of the fluid, and the length to which it would extend itself by the degree of expansion, in the course of issue. The reduction in quantity of discharge, due to the action, was to be measured by the velocity imparted by expansion, to each particle of the elastic fluid in course of issue, the velocity of each particle after expansion, would be its velocity before expansion, multiplied into the rate of expansion, and the primary force must be subdivided in generating each additional unit of velocity, so that the portion applicable to the generation of velocity before expansion, would be the whole force divided by the rate of expansion ; thus, the velocity before expansion would be divided by the square root of that rate. For instance, an elastic fluid expanding four times in course of issue, would be discharged with only half the velocity of a non-elastic fluid, under the same circumstances of pressure and density. This modification was shown to fulfil the general dynamical law "that a given force, acting for a given time, will produce a given momentum, whatever be the weight of the mass acted upon." This seemed to be the essence of the law for non-elastic fluids, but it was disregarded by the unmodified application of that law to elastic fluids, in which there would be a great accession of velocity of particles issuing under a given pressure, without any reduction of quantity discharged in a given time; if, however, the quantity be reduced as proposed, in the ratio of the square foot of the density, and the velocity be accelerated in the same ratio—the final momentum would be the true equivalent of the pressure. This, in its practical application, explained what was inexplicable by the ordinary theory; the difficulty experienced from the back pressure of the waste steam in locomotive engines, and a diagram was given, showing, that at 60 miles per hour, this would be at the least equivalent to 8 lbs. per inch throughout the stroke, thus showing a loss of nearly 50 H. P. As applied to the case of air, discharged into an exhausted receiver, the result was highly curious. The rate of discharge, instead of increasing throughout as the degree of vacuum was increased, would be maximum at 15 in. of vacuum, although nearly uniform for many inches above and below that point; it would, however, progressively decrease above that point, because the expansion would increase in a higher ratio than the pressure, and ultimately, at the point of perfect vacuum, it would be at a minimum (indeed stationary, were air perfectly elastic), because at that point the expansion would be infinite, but the pressure only finite—viz: 30 in. of mercury. Experiments made, by permission of Mr. Brunel, with the South Devon Railway atmospheric apparatus, confirmed the theory. The line traced by an indicator apparatus was shown to accord very closely with one traced by this theory, whilst it was widely at variance with the result of the ordinary theory. Ibid.

Valuable Alloys.

The *Paris Scientific Review* has published for the benefit of the industrial workers in metals, the best receipts for composing all the various factitious metals used in the arts.—The following are a few:—Statuary bronze—Darcet has discovered that this iscomposed of copper, 91·4; zinc, 5·5; lead 1·7; tin, 1·4. Pinchbeck—copper, 5; zinc, 1. Bronze for cannon of large calibre—copper, 90; tin, 10. Bronze for cannon of small calibre—copper, 93; tin, 7. Bronze for medals—copper, 100; tin, 8. Alloy for cymbals—copper, 80; tin, 20. Metal for the mirrors of reflecting telescopes—copper, 100; tin, 50. White argentan—copper, 8; nickel, 3; zinc, 3½—this beautiful composition is an imitation of silver to the degree or 750·1000. Chinese silver—Mons. Meurer discovered the following proportions—silver, 2·5; copper, 65·24; zinc, 19·52; nickel, 13; cobalt of iron, 0·12. Tutenague—copper, 8; nickel, 3; zinc, 5. Printing characters—lead, 4; antimony, 1. For small types and for stereotype plates—lead, 9; antimony, 2; bismuth, 2. Ibid.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA,

FOR THE

PROMOTION OF THE MECHANIC ARTS.

OCTOBER, 1847.

CIVIL ENGINEERING.

Remarks on the Report of Mr. James Walker and Capt. Simmons, on the late failure of the Chester Bridge.

We have before us the report of the officers, sent down by the Commissioners, to examine the Dee iron bridge, the breaking of which caused the fatal accident on the 24th of May. Upon the whole, the document is a pretty fair one, but more valuable for the facts it contains, than for the opinions it offers. The conclusions the reporters came to, are—

"That the bridge was of sufficient strength, if the cast and wrought iron be supposed to act together, each taking its equal portion of the strain.

"That there is great difficulty in insuring the joint action, and that, if this is a part of the principle of the bridge, we do not approve it.

"That neither the wrought nor cast iron, taken separately, was sufficient for perfect stability, and that, to have insured this, the cast iron girders alone, should have been of sufficient strength to carry the whole weight, with an ample allowance for the various circumstances, (some of them peculiar to this bridge,) which we have explained.

"That, with the exceptions of the bends or warps in the top flanges, the castings are of good quality.

"That the wrought iron is of good quality.

"That the stone-work of the piers and abutments is good, and in no way contributed to the failure."

Our readers will remember that this bridge is a skew bridge, constructed of straight cast iron girders, and consists of three equal spans of 98 feet each. The girders rested on four stone piers; two land piers at the extremities, and two piers in the bed of the river. The girders were straight, about 35 feet long, with an upper and a lower horizontal flange or foot, the lower being three and a half times the length of the other. Artificial shoulders were also bolted on to the upper ends of each girder, to give a greater pressing space at each joint; and the wrought iron tension rods were fastened to the top of the shoulders of the girders resting on each stone pier, and then passed down to the bottom of the girder, where the second girder joined the first, along the bottom side of the second, and again obliquely up to the top of the shoulder of the third girder, resting on the pier. The object of these tension rods, which were bolted to the joints of the middle girder, with the first and third, was to give strength to the bridge. Upon this point we do not see our way clear to offer an opinion, without more study of the principle than we can afford time to give it. We, however, may be permitted to call attention to a practical proof of an observation, which we made in opposition to the opinion of the jury, about the time of the inquest. The jury seemed to admit that the bridge was strong enough for a train to go gently over it, but not rapidly. Upon this we observed, that the pressure of a train in rapid motion ought to be less than that of one moving slowly. That, it seems, has been proved by Captain Simmons. He found that "an engine and train, of 48 tons, gave a deflection of 2·40 inches, while the deflection caused by the same train, at a speed of 15 or 20 miles an hour, was only 1⅝ inch."

It must, however, be observed, that the characters of these deflecting causes are not the same. The deflection from the train in motion approaches nearer and nearer, as the velocity is higher, to that caused by percussion, the deflection at rest being that due to simple pressure This is one reason why we should always have no immediate contact, or rigid material, between the rails and the girders of iron bridges. They should be as far as possible asunder, and the material between them be of the nature of caoutchouc, to deaden and destroy the percussive effect of the train. Though we are not friendly to iron bridges, we have little doubt in our own mind, that the fall of this bridge was the consequence of some blow, and not of the natural action of the train. But the statement of the engine-driver, that he was fifty feet from the end of the bridge, when he felt it giving way, and that he laid on the full steam, and then, by a sort of leap or bound, "succeeded in clearing the bridge with his engine, and dragging the tender up after him," borders too much on the marvellous, to find credence with us. We have no faith in such statements, simply because they are impossible. An engine, if it were loose, could not be made to bound—it is too weighty—and, in connexion with the train, it is miraculously absurd. No; the engine must have been much nearer than the man states. Probably the forepart of it was over, or nearly over, the pier; and then, as the bridge was falling in the middle, it formed an incline, up which the engine, by its momentum, might have been carried, and pulled the tender up after it.

The reporters came to the conclusion, that the "immediate cause of the accident" was, "by the tender having got off the line, and broken the girder by a heavy lateral blow."

In the opinion of its being a lateral blow from something, we concur, but whether it was from the tender, or any other part of the train, does not appear clear to us. The Report, however, is very well managed to agree with all sides. With the opinion of Mr. Yarrow it agrees, that the girders were not, alone, strong enough to support the bridge; with the opinion of Mr. Stephenson it also agrees, that the bridge was quite strong enough, IF the tension-rods added their strength to that of the girders; and with Mr. Stephenson, and some others, it also agrees, that the fall was caused, not by a fracture from the pressure, but from a side blow. It has, therefore, the admirable property of fanning the vanity of all parties, siding with all, and opposing none. It is perfectly Walkerian, and will go either way, and every way.—But the little IF, about the utility of the tension-rods, it leaves IF still; so that, *if* future inquiries should prove them useful, the reporters will not be wrong,—and, *if* useless, still they will not be wrong. It really requires great address to draw up a Report of this kind, which, like a weather vane, will accommodate itself to any and every wind that blows. No man in the profession, that we have ever heard of, except Mr. Walker, could do it. We, therefore, congratulate Captain Simmons on having so wonderful a master, by whom to learn to model his Reports, and to be able to say everything, agree with everybody, and settle nothing. Lond. Railway Mag.

Improved Locomotive Engine.

For some time past, considerable attention has been excited among parties connected with locomotive transit, by the performance of an engine built upon a new principle, by Mr. Crampton, civil engineer, [see Athenæum, ante, p. 391,]*—and upon which very extensive experiments have lately been made, on the London and North-Western Railway. The engine in question, which has been, for a few weeks, taking the express, mail, and ordinary trains on that line, and performing its work in such a manner as to effect a saving of from 20 to 50 minutes, in a through distance of 50 or 60 miles, was tried last week without a train, for the purpose of testing its rate of speed: when it was found that, with Capt. Coddington, Inspector-General of Railways, Capt. Simmonds, Assistant-Inspector, and the patentee, Mr. Crampton, on the engine, it attained the extraordinary speed of 75 miles per hour, on a level, immediately after surmounting a rising gradient; and that, at this great rate, there were a total absence of all vibration, and a steadiness of movement perfectly surprising. These great advantages are effected in Mr. Crampton's engine, by the centre of gravity being brought down to its lowest possible point; the boiler, in fact, being, in this machine, within two feet nine inches of the rails, whilst, in engines of the old construction, it ran, at the very least, five inches (?) above their level. The peculiarities of this engine consist in the driving-wheels being placed at the foot-plate end of the boiler; by which means, the boiler itself can be brought down close to the supporting axles of the engine—and, from the peculiarity of form before mentioned, any size of driving-wheel may be used, without interfering with the position of the boiler, so that longer boilers can be used if necessary. Another advantage, secured by this method of building engines, is, that no part of the engine overhangs the wheels; inasmuch as the fire-box is extended under the boiler and driving-axle—by which, also, the distance between the extreme wheels is reduced three feet. The engine in question, the Namur, has only 13 feet between them, whilst, in ordinary engines, the same amount of power would require 16 feet. In addition to these advantages, the driver has the whole of his machinery in view at one time, and, in no case, is required to get under his boiler for repairs. So satisfactory have these and other trials been, that the North-Western Company have ordered of the patentee, an engine, of a power nearly equalling that of the monster engine on the Great Western Railway; which it is thought, when completed, may, perhaps, by its performances, tend materially to set at rest the long-pending dispute, as to the superior eligibility of the broad or narrow gauge. Athenæum.

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* See, also, Journal Franklin Institute, page 143—present vol.

Warming and Ventilation of the New House of Peers.

We have been requested to give an account of the system adopted by Mr. Barry, for the warming and ventilating the new House of Peers. We cannot do better than give Professor Faraday's account, read at the Royal Institution:—

Mr. Barry's plan of warming and ventilating the three rooms, to which he has applied it, (*i. e.*, the royal ante-chamber, the House of Peers, and the public lobby,) consists, first, in causing a current of air, of regulated temperature, to pass beneath the impervious floor of these apartments, and afterwards to rise to a chamber at the top of the building, from whence it is diffused in great abundance, but imperceptibly, throughout the three apartments; and secondly, in drawing off the vitiated air, and discharging it with great rapidity into the atmosphere. To accomplish these objects, Mr. Barry has achieved expedients for, 1. Warming the building through an impervious floor, as in the case of a Roman bath. 2. Effecting a system of currents. 3. Providing means of causing ten thousand cubic feet of air per minute to proceed in a prescribed course, and with regulated velocity.

The warming is effected by a steam-cockle, supplied from one of Lord Dundonald's boilers; it is traversed by a quantity of air-tubes, firmly fastened into it. The air which passes through the tubes, is the source of warmth. This apparatus, with its furnace, is placed beneath the public lobby; and the current of warm air passes beneath its impervious floor, then beneath that of the House of Peers, and lastly, beneath the floor of the royal ante-chamber beyond. With warmth, the air acquires a certain degree of motive power in the rising parts of the passages, which carries it onwards, till it reaches the reservoir chambers at the summit of the building; from thence, it is made to pass down into the apartments by their walls, and so distributed, without draught, to be breathed by the inmates of those rooms. This gradual diffusion of the air is accomplished by a system of currents. It is caused by subjecting the air to inequalities of temperature. Descending by the walls of the building, it is cooled by windows, &c., and thus its velocity downwards is increased. Arriving at the level, at which it is at once heated, and deteriorated by respiration, combustion, &c., the air again rises in the centre of the room, and passes through the ceiling, into a foul-air chamber, which is in connexion with a chimney. Through this chimney, the air is driven by the third expedient adopted by Mr. Barry, viz., draught of the flue,—and a peculiar motive power furnished by Bell's steam jet, a source of force which has so many philosophical considerations connected with it, that Mr. Faraday expressed it his intention of making it the subject of a future day's discourse.* He therefore limited himself, at present, to the simple statement that steam, produced under 32lb. pressure on the square inch, will set in motion 217 times its bulk of air.

In the course of his communication, Mr. Faraday described the arrangements made by Mr. Barry, to clear the air, and to regulate its velocity, so as to prevent the possibility of draughts coming on any inmates of the apartments. He showed how the steam-cockle, employed to give warmth in winter, might, by filling it with water from the Artesian well, become a source of coolness in summer. These, and many other important arrangements, were illustrated by sections in relief.

The advantages expected from this mode of ventilation, are, 1. The prevention of local draughts. 2. The prevention of the stains and disfigurements resulting from such draughts. 3. The avoidance of all movement, and dispersion of dirt and dust of the house, by currents occasioned in it, which currents, if existing, would tend to render the air impure. 4. The avoidance of all sudden change of temperature. Finally, it was noticed that all parts of the house were fire-proof.—Mr. Faraday then took occasion to remark, that this scheme of ventilation was under a disadvantage in the present case, as it had to be adapted to buildings which were not planned with reference to it.

Civ. Eng. & Arch. Jour.

BIBLIOGRAPHICAL NOTICE.

The Bankers' Magazine.

We have received several numbers of "The Bankers' Magazine, and State Financial Register," published at Baltimore, until the number for September, which bears on its cover the imprint "No. 17 Wall Street, New York." The editor and publisher is J. Smith Homans.

This magazine is specially devoted to the dissemination of information concerning the Statistics of Banking and State Finances; the

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* See page 212 of the present volume.

Principles of Banking and Currency; Decisions in the Law Courts of America and England, on questions connected with the business of bankers and banking; matters relating to Insurance, Savings Banks, &c.

The pages of this monthly periodical contain much well digested and practical information, on subjects relating to finance, and money statistics in general. It should be in the hands of all who have the direction and management of institutions established for fiscal purposes, and will also be found useful to individuals, whose business is of such a nature, as to embrace extensive banking or financial operations. We know of no publication, of this kind, better adapted to convey useful and reliable information, concerning the subjects to which it is devoted, and recommend it to the notice of such banks, bankers, financial institutions, and persons connected with business of this kind, as have not yet availed themselves of the knowledge to be acquired from its perusal.

FRANKLIN INSTITUTE.

Monthly Meeting, August 19, 1847.

The usual business of the Society was transacted, the Correspondence read, Donations announced, Reports from the Treasurer and the various Committees received, new members proposed and elected, &c.

The next order of business being Communications on Subjects connected with Science and the Arts:—

Mr. S. W. Roberts, who had recently returned from a visit to the "Mammoth Cave," in Kentucky, laid before the meeting a map of the cave, on which are traced the intricate windings, and intersections, of the numerous passages constituting this subterranean wonder, which now, by the assistance of guides, may be safely explored by visiters, for a distance of nine miles from its entrance. Its dark avenues are crossed by several considerable streams, across which visiters are ferried in boats, and in which several kinds of fishes may be caught.—These inhabitants of waters upon which the light of day never shines, are of a dull white color, and are, apparently, entirely destitute of the usual organs of vision. One of these eyeless fishes, taken from a stream in the cave, about four miles from its entrance, was presented to the Institute, by Mr. Roberts. He gave a brief and general description of the cave, accompanied by some interesting statements of his observations, while exploring the interior of this vast subterranean recess.

We hope Mr. R. will furnish, for the Journal, a more extended and minute account of his visit to this remarkable cavern.

Mr. Picot exhibited a cooking apparatus, called the "Calefacteur Cuisine," made by Lemare, of Paris, and imported for Mr. P. It is constructed chiefly of tin, and consists of an outer cylinder, about 10 inches high, and of the same diameter, within which is an elliptical vessel, whose longer and shorter diameters are, respectively, 9¼ and 6½ inches,—the space between this and the outer cylinder, being kept filled with water when the apparatus is in use. This place for containing water has two apertures, one, consisting of a pipe or funnel, in the permanent cover which unites the inner and outer vessels, through which the water may be introduced; and the other, a small elbow-pipe, bending outwards and downwards, for conducting off the steam. There is also a common brass stop cock inserted in the side of the outer vessel, near the bottom, from which hot water may be drawn. The interior elliptical vessel is two inches higher than the cover which unites it to the outer cylinder,—this projecting portion being pierced with holes, to allow the escape of gas from the fuel.—Through the double bottom of the interior vessel, there is a circular opening, 1½ inches in diameter, to supply a draught of air for the combustion; this opening may be partially or wholly closed, by a sliding valve or register. A movable elliptical plate, of pierced sheet iron, is fitted within the inner vessel, near the bottom, on which the charcoal used for fuel is sustained. In the empty space above this, the boilers, single and double, together with sauce pans, stew pans, coffee roaster, and various other accompanying conveniences for cooking operations, may be inserted at pleasure. The steam pipe communicates with a detached lateral vessel, of the same shape and size as the inner elliptical container, in which vegetables, or other articles of food, may be prepared by steam, while the other portion of the apparatus is employed in boiling or roasting.

The whole apparatus is exceedingly neat and compact, and appears to be well calculated for the saving of both time and fuel. Mr. Picot said, that, with one pound of charcoal, costing less than two cents, a dinner of seven different dishes, roast, boiled, and stewed, sufficient in quantity for seven or eight persons, may be cooked in the usual time, and with much less attention, than is required in the ordinary methods in common practice. The space between the inner and outer vessels, being always kept filled with water, presents a constant supply, ready heated for use; and, in case of a delay in serving up the dinner, after the cooking is completed, all the viands may be kept hot, for an hour or more, by simply closing the register, to prevent the admission of cold air into the furnace, after the extinction of the fire; the cistern of hot water, which surrounds the inner vessel, imparting sufficient heat to the cooked articles, to maintain them at the desired temperature for a considerable time. The escape of heat is also prevented by an exterior hood or covering, so constructed as to envelope the whole apparatus.

This very convenient and economical contrivance, is deserving of attention from our ingenious workers in tin and sheet iron.

Mr. G. W. Smith offered, for the inspection of the members, a polished transverse section of a bar of railroad iron, (H pattern,) which had been immersed in very dilute nitric acid, and connected with a plate of pure silver, in order to produce galvanic action; the unequal degree of corrosion thus produced upon the different laminæ of iron composing the bar, displayed the direction of these laminæ, and their arrangement as produced by the action of the rollers. Mr. S. announced his intention of making further experiments in relation to this subject.

A specimen of *Gutta Percha,* presented for the Cabinet of the Institute, by Mr. Lennig, was submitted to the examination of the members present.

This is an article of recent introduction into commerce and the arts, having been first brought into notice in England, towards the close of the year 1843. It is used by the Malays, to form handles for knives and other implements, being preferred by them, for such purposes, to wood or horn. It is procured from a tree which grows abundantly in Malacca, in Borneo, and some of the islands of the Indian Ocean. This tree yields a milky juice, which, when coagulated in masses, forms the substance known as gutta percha.

The color of this article is a dark grayish brown, and it has somewhat the appearance of horn, being, below the temperature of 50°, nearly as hard as that material, exceedingly tough, and only flexible in the state of thin slips. By an increase of heat it becomes more flexible, and, at a temperature considerably below the boiling point of water, a mass of it becomes so soft as to be easily cut with a knife, and may be divided into portions of any size, and moulded into any desired form. If a hard and rigid mass of it be dipped into boiling water, until it becomes heated throughout, it is rendered as plastic as clay, and, on again cooling, returns, unchanged, to its original hardness and rigidity. When in a soft state, it may be separated and joined again, so perfectly as to show scarcely any appearance of the joint, and the united mass is as firm as if it had never been divided. Being moulded into any shape, while in the plastic state, it will retain the same form upon cooling; and it is an important fact, that these processes of softening, moulding, and hardening, may be repeated any number of times, without injury to the material. When cold, it possesses but little elasticity; its tenacity, however, is very great, a writer in Chambers' Journal declaring that "a thin slip, of only an eighth of an inch in substance, sustained a weight of 42 pounds, and was only broken by a pressure of 56 pounds." Though differing greatly from caoutchouc, in its hardness and flexibility, it appears to have some of the properties of that substance; burning brightly when ignited, and giving forth the peculiar odor emitted by india rubber when burned. It is soluble, with difficulty, in ether, and other solvents of caoutchouc; but dissolves readily in spirits of turpentine. In its chemical relations, gutta percha differs little from caoutchouc. The specific gravity of the former is 0·9791; and of the latter, 0·9355. According to Soubeiran, an analysis of gutta percha, in a state of purity, yielded carbon 87·8, hydrogen 12·2; and caoutchouc, according to Faraday, gives carbon 87·2, hydrogen 12·8.

This substance promises to be extensively useful in its application, and a number of patents have already been secured in England, with reference to its employment in the manufactures and the arts. In its hard state, it may be used for purposes to which india rubber is not applicable, and, in solution, it appears to be well adapted for many purposes for which that article is now used. Its toughness, and hardness, would seem to fit it as an admirable substitute for leather in many cases; and, as a cementing agent, it will probably be found of great value. One of the patentees proposes to combine gutta percha, caoutchouc, and another substance, called *jintawan*, by which an elastic compound may be formed, which is impervious to water, and in which, by varying the proportions of the ingredients, it is said that any requisite degree of hardness or flexibility may be obtained. In its various modifications, from a substance as hard as ivory, down to a liquid solution, to be used as a varnish, it is scarcely possible to imagine the multiplied uses to which it may be applied. Time, experiment, and practice, can only determine the extent of its application to useful and ornamental purposes, and its consequent value and importance as an article of commerce.

Mr. T. B. Adams exhibited some specimens of gun cotton, prepared by Messrs. C. &. F. Lennig, of Philadelphia, in December last, which had remained since that time, loosely wrapped in paper, but which still retained their explosive quality in full degree. He proceeded to make some observations concerning the qualities and uses of this article, and referred to a number of experiments, made by himself and others, in order to test its effects, as compared with those of gunpowder.

Gun cotton, he said, is improved by immersing it in a weak solution of nitrate of potash, after having been washed from the acid. For blasting rocks, or in mining operations, he considers it greatly superior to gunpowder; its freedom from smoke rendering it particularly desirable to underground miners. Being compressed into cartridges of a proper form and size, the operation of charging is greatly facilitated; and, not being liable to be spilled or scattered about, as gunpowder is, there is much less loss and danger of accident, than where powder is used. He regards its action upon the rock as less wasteful than that of gunpowder, inasmuch as it cracks or severs the material, without throwing it into the air, or pulverizing it;—an important consideration to coal miners. These reasons, he says, have induced the English miners, generally, to adopt it, and a considerable saving has resulted from its use.

With regard to the use of gun cotton in fire arms, Mr. A. said that the experience of many sportsmen has shown that it is superior to gunpowder, on account of its initial force,—its making no smoke,—the recoil being less,—and the report weaker than when powder is used. Well prepared cotton leaves no foulness in the barrel, and the gun only requires cleaning when put away after use. Respecting the corrosive action of gun cotton on the barrel of the piece, Mr. A. said, that Mr. Dupont had made an experiment, using a tube of iron, from which he fired 60 grains of cotton, in 30 charges, by which the tube lost five grains in weight. Mr. Adams then produced a tube, which he said was carefully washed in alcohol, and weighed at the United States Mint, previously to its being used. After firing from it 177 charges of gun cotton, covered by wads, the tube was again carefully weighed, and the loss was found to be only $\frac{8}{10000}$ of an ounce troy.

In relation to the comparative force of gun cotton, as compared with powder, Mr. A. presented the following results of experiments: With a gun barrel, 20 inches long, using a charge of about 30 grains of cotton, shot of No. 9 size were driven, at a distance of 25 yards, through 51 leaves of a book; and, with 20 grains of cotton, through 30 leaves. With the same barrel, and the same distance, using a charge of 1¼ drachms of Curtis & Harvey's powder, shot of the same size were driven through but 23 leaves. With another barrel, 31 inches long, a charge of 1¼ drachms of powder drove the shot, at 25 yards, through 21 leaves of the book;—and 18 grains of cotton through 12 leaves. With a pistol barrel, 7 inches long, charged with 9 grains of cotton, No. 7 shot were driven, at 10 yards, through 22 leaves; and, with a charge of 12 grains of cotton, through 34 leaves. He also referred to experiments made in blasting with gun cotton, at the coal mines near Pottsville, in which very satisfactory results were obtained.

In connexion with this subject, *Prof. W. R. Johnson* said, that during the last week he had witnessed a trial of gun cotton, in a rifle, and in blasting rocks. From four to six grains of the cotton were found to be an ample charge for the rifle, giving a sufficient projectile force for a distance of 100 yards. He thinks that, when the gun cotton is properly used, the danger of bursting fire arms, and the recoil of the piece, are not greater than in the use of gunpowder; and conceives that further experiments will establish this as a fact. The experiment in blasting, at which he was present, was considered imperfect, owing to a defect in the mode of application, and, therefore, not such as to admit of a comparison with the effect of gunpowder.

Mr. S. W. Roberts expressed a hope that gun cotton, in connexion with the safety fuse, would be brought into general use, for blasting and mining; considering it to be more convenient of application in certain situations, safer in practice, and the liability to accident less than in the common method of blasting by means of gunpowder.

Prof. W. R. Johnson submitted a verbal statement of the result of an examination of the scales adhering to the interior of the boiler of the Government steamer "W. L. Marcy," presented at the last meeting of the Institute.

The specific gravity of these scales is 2·695. They are laminated and crystalline, with minute prismatic columns crossing the thickness of the deposite. The color is nearly pure white; the side which appears to have been next to the metal, is marked with small black specks, apparently of oxide of iron.

Their hardness is such, as to allow of being scratched with the nail, but the side which adhered to the iron is perceptibly harder than the other. Acids produce, on them, no effervescence or other evidence of reaction.

It had been stated, at the time these incrustations were presented to the Institute, that the use of *ammonia* in the boiler, had been found to obviate the difficulty arising from this deposite. Doubts, however, had been expressed, whether the remedy were due to a true chemical reaction.

Presuming that, by *ammonia* was meant *sal ammoniac*, some trials were made, to determine the efficacy of that salt, in dissolving the scale, as compared with one or two other reagents applicable to the same purpose.

Having weighed 38 grains of the scale, in small fragments, but not pulverized, they were boiled for an hour, with 27 grains of chloride of ammonium, (sal ammoniac,) in about four ounces of distilled water, until no farther effect appeared to be produced. The scales had become rather more friable than before, but their form and structure were unchanged.

The liquid, with the washings of the undissolved fragments, treated with chloride of barium, gave of ignited sulphate of baryta 4·05 grains, proving that about 1·39 grains of sulphuric acid had been already brought into solution.

The undissolved scale, dried at 212°, was found to have lost 2·9 grains, or 7·6 per cent. As the scale had, at first, been weighed without drying, a small part of this loss is probably attributable to hygrometric moisture.

The residue was next boiled in a solution of carbonate of potash;—the resulting sediment separated, washed, dried, and heated a little below redness, and found to be completely soluble, with effervescence, in chloro-hydric, nitric, and acetic acids. The solid crystalline scale had, in fact, been converted into a pulpy or flocculent mass of carbonate of lime.

The liquid which had been filtered from sulphate of baryta, after boiling with sal ammoniac, having first been freed from excess of baryta, gave, with oxalate of ammonia, a copious precipitate, showing that *lime* had been dissolved.

On the other hand, the liquid filtered from carbonate of lime, having been acidulated and boiled, gave, with chloride of barium, equally abundant proofs of the presence of *sulphuric acid.*

The foregoing trials prove that sal ammoniac *is* capable of reacting chemically, to dissolve, in part, the incrustation; and carbonate of potash, to decompose without completely dissolving it;—leaving, at least, carbonate of lime, insoluble, and capable, under certain circumstances, of still forming a scale.

It being thus made evident that the incrustation is one of the sulphates of lime, and, by negative proofs, ascertained that the clean scale contains no other essential material, an analysis was performed, which resulted in showing that it belonged to the same species as the crystals formerly analyzed by Prof. Johnston, of Durham, containing two equivalents of dry sulphate of lime, to one equivalent of water; in other words, it was *di-hydrated* gypsum, $= 2CaO,SO^3 + HO$.

To prove more exactly the relation between the respective solvents, 10 grains of the scale, freed from dirt, were finely pulverized, heated to dull redness for 20 minutes, losing thereby three per cent. of water, and then boiled in three successive portions of a strong solution of sal ammoniac. By this treatment, almost exactly *one-half* of the dried powder was found to have been dissolved. The remaining half was boiled with 20 grains of pure carbonate of potash, in four ounces of distilled water, by which it was rendered completely soluble in chloro-hydric acid.

Wood ashes may probably be substituted for carbonate of potash, without serious inconvenience; and, to aid the decomposing power, as well as to give completely soluble compounds, acetic acid, or even common vinegar, may take the place of chloro-hydric acid.

To prove the utility of this solvent, (the acetate of potassa,) a quantity of acetic acid was slightly supersaturated with carbonate of potash, and a portion of the powdered scale was boiled in the solution for about one hour. A few light, flocculent particles only remained undissolved, indicating a superior facility of decomposition, to that of chloride of ammonium, and yielding acetate of lime, and sulphate of potassa,—both soluble salts.

Besides the scale of the sea steamer, trial was made of one, similar in aspect, obtained some years ago, from a stationary boiler used at or near the glass works of Mr. Bakewell, in Pittsburg. That scale had, likewise, a crystalline structure, with small transverse prisms. It had a dirty white color, was marked with black specks on the side which had adhered to the boiler, and was, without difficulty, scratched with the nail. It was not attacked by acids.

When 19·8 grains were heated to bright redness, for more than an hour, the loss was ·55 grain, or 2·77 per cent. As the color and lustre of this scale are less remarkable than that of the sea steamer, the sulphate of lime is doubtless contaminated with some earthy impurities, and probably with a little animal or vegetable matter, but the quantity of water expelled, clearly indicates that it belongs to the same class of hydrates as the seawater scale.

In fact, as it is known that a temperature of 300° expels the water from common gypsum, it is inconceivable that true *bi-hydrated* sulphate of lime should be formed within a vessel, in which prevails a temperature often above that limit.

Two or three varieties of scale, from boilers using the water of the Schuylkill, were compared with those above described.

The first was from a boiler used at Smith's factory, near Fairmount.

This scale is dark grey, and, in many parts, almost black. It has a slight scent of animal oil. This odor became abundantly perceptible, on heating to 400° or 500°, and the thick smoke, and strong smell of lamp-oil, leave no doubt as to the source of this impurity. Exposed for 10 minutes to a dull red heat, in daylight, it lost 8·65 per cent., nearly the whole of which was organic matter.

Treated cold, with chloro-hydric acid, till effervescence ceased, and then boiled with an excess of acid, it lost 83·66 per cent. more, leaving a nearly black powder, (part of which was proved to be sulphate of lime,) amounting to 7·69 per cent.

Hence, the predominant material in this scale, that to which it owes its chief properties, is carbonate of lime. Faint traces of the crystalline structure, already observed in the scale from salt water, and in the Pittsburg scale, were also found in this, and may, probably, be due to the portion of sulphate of lime ascertained to be present.

A second scale, of a character similar to the last, from the boiler of

Mr. Coggins, also consists chiefly of carbonate of lime, of a reddish brown color; and a third, from the connecting-pipe of a boiler, which exploded a few years since at Kensington, is of the same general character, but less compact, and of a nearly flesh-red color. An obvious solvent for this scale, will also be found in acetic acid, or in a substance which can yield that acid to the lime.

SPECIFICATIONS OF ENGLISH PATENTS.

Specification of a Patent granted to Alfred Vincent Newton, *of the County of Middlesex, for an invention of improvements in the method of heating, hardening, and tempering various articles made of steel, or of iron and steel combined.*—Sealed 24th September, 1846.*

This invention consists in the construction and application of certain apparatus, which is intended to ensure the proper heating of articles required to be hardened or tempered. The apparatus represented in the drawings accompanying the specification, was designed principally for the heating, hardening, and tempering of axes; but, under proper modifications, which will readily suggest themselves to any competent workman, every variety of article, requiring to be submitted to such processes, may be treated according to this invention.

For heating axes or other similar articles, a heating furnace is constructed, in the form of a vertical cylinder. The exterior of this cylinder may be made of sheet-iron, say four feet eight inches in diameter, or varying therefrom in such a degree, as shall give to its interior a diameter of four feet, when lined with fire-brick;—its height may be about three feet. In the interior of this cylinder, several fire-chambers are formed, the number of which is usually four, dividing the circle of brick lining into eight equal parts, so that there shall be a space of fire-brick between each of the fire-chambers. The inner wall of each fire-chamber is formed by a circle of three feet four inches in diameter; each of the fire-chambers is, therefore, about eighteen inches long, about four inches from front to back, or from one of its circular sides to the other, and it may be about four inches also in depth; the ends of each of the chambers may be parallel, or nearly so. Under each there are grate-bars, and air is supplied to them through a pipe, connected with a blowing apparatus.

A circular table, usually of cast-iron, three feet four inches in diameter, (which is the same with that of the interior circle of the fire-chambers,) is made to revolve slowly, on a level with the upper part of the said chambers. This table is sustained on a central shaft, which passes down through the bottom of the furnace, and has its bearing in a step below it; a pulley, keyed on to this shaft, serves to communicate rotary motion to the table.

When the axes or other articles are to be heated, they are placed upon the table, with their bitts or steeled parts projecting so far over its edge, as to bring them directly over the centre of the fire; and the table, on which they are thus situated, is kept slowly revolving during the whole time of heating; the time required being governed by the size of the article under operation. When duly heated, they are ready for the process of hardening.

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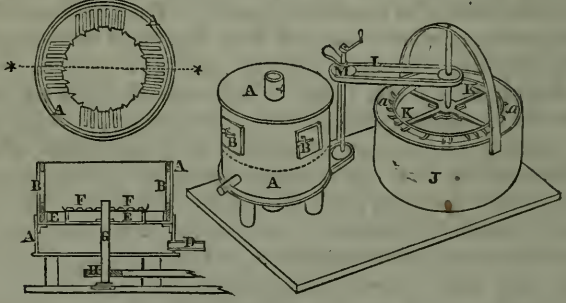
* Patent obtained by D. C. Collins, of Collinsville factory, Connecticut. Specification prepared by the Editor, T. P. Jones.

The hardening bath consists of a circular tub or vat, wherein the hardening liquor (usually composed of water containing salt) is placed. Within this tub or vat, a little above the surface of the liquid, is a wheel, mounted horizontally, and made to revolve by means of a band and pulley. Around the periphery of this wheel, a number of hooks or pins are provided, upon which the axes or other articles are to be suspended, as they are taken from the furnace; the height of these pins from the liquid, is such as will allow the lower part only, or bitt, to be immersed therein. The temperature of the hardening liquid is kept down, by having a large reservoir thereof in the ground below the tub or vat; from which reservoir fresh liquor is pumped into it, as required; and that which has been heated is allowed to flow back again into the said reservoir, which, being a few feet below the surface of the ground, and of considerable capacity, preserves the liquor at a sufficiently low temperature. As soon as the hardening of the steeled portion is effected, the axes or other articles are removed from the hooks or pins, and the heads are cooled by dipping them in cold water.

Fig. 3. Fig. 1. Fig. 2.

Fig. 4.



Figs. 1, and 2, represent, in perspective views, the furnace and the hardening tub; fig. 3, is a plan view of the interior of the furnace, the upper part, or top plate thereof, being removed; and fig. 4, is a vertical section, taken in the line * * of fig. 3. A, A, is the furnace; B, B, are the furnace doors, through which the fires are fed, and the articles to be hardened are adjusted; C, is the chimney for carrying off the gaseous products of combustion; D, the pipe for supplying air to the fire; E, E, the fire chambers; F, the revolving table, upon which the axes, or other articles to be heated, are placed; and G, is a vertical shaft, provided with a winch-handle, and carrying a pulley H, which, by means of an endless band I, communicates rotary motion to the pulley, on the shaft which supports the table F, and thus causes it to revolve.

J, fig. 2, is the hardening-tub; and K, is a wheel, mounted horizontally in the tub J, and furnished, on its periphery, with pins or hooks *a*, *a*, upon which the axes or other articles are to be hung. This wheel may be kept revolving by means of an endless band L, passing round a pulley M, on the shaft G, and also round a pulley on the shaft of the wheel K.

It is well known to persons intimately acquainted with the manufacturing of edge-tools, that the most difficult part of the operation of hardening and tempering, is the giving of a uniform and proper degree of heat to the piece to be hardened. The exact degree of heat to be given, will, it is true, vary according to the nature of the steel to be operated upon,—as, what is called high steel, will require to be less highly heated, than that known as low steel; the experience and judgment of the operator being the only guide in this particular. But, whatever be the quality of the steel, the equal heating of all its parts is of the utmost importance; and, in articles of any considerable size, this cannot be effected in the ordinary mode of procedure, with an open fire. Where articles are unequal in thickness, as is usually the case, the difficulty is much increased; but even where the thickness is equal, the difficulty is not removed. When the articles to be heated are placed over an open fire, one side of the steel is exposed to its action, and the other, in a greater or less degree, to that of the atmosphere, and the utmost care and skill cannot entirely overcome the unequal heating resulting therefrom.

In the apparatus which forms the subject of this invention, it is stated that all parts of the steel may be equally exposed to the action of the fire, the intensity of which may be increased as the articles become heated, and all danger of heating the thin more highly than the thicker parts, is removed; they are, consequently, equally expanded in all their parts, and the danger of producing cracks or other injurious effects, from unequal contraction in hardening, which often destroys the tools, does not exist.

It has been already stated that the apparatus, as herein described, is so formed as to adapt it to the heating and hardening of axes. To these, the table F is particularly adapted; but, for the support and exposure of other articles to the action of the fire, the outer edge of the table must be furnished with devices, adapted to them in a manner that will occur to any competent workman.

The improved method of tempering articles manufactured in whole or in part of steel, is similar to that above described for heating such articles for hardening, and consists in submitting them, for a sufficient length of time, to an atmosphere or bath of heated air, which is to be brought up to, and kept at, the temperature required for the tempering, and which will vary according to the nature of the steel employed, and of the tool or other article to be tempered. To effect this object, the inventor constructs an oven, which may be formed of iron or other material; and, with this oven, a furnace and air-flues are so connected and arranged, that the air contained in the oven may be as highly heated as is deemed necessary, whilst its temperature can be regulated by the introduction of cold air at any time. For the purpose of ascertaining the temperature of the oven, a thermometer is employed, the bulb of which is to be exposed to the action of the air contained in the oven. The articles to be tempered may be placed on a carriage or wheel, which may be made to revolve or move within the oven; the air will, by this means, be in some degree agitated, and the articles to be operated upon will be made to occupy different parts of the oven. A device of this kind may not be absolutely necessary, but it is undoubtedly useful and convenient.

Fig. 5.

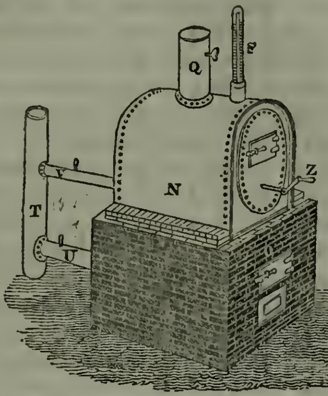


Fig. 6.

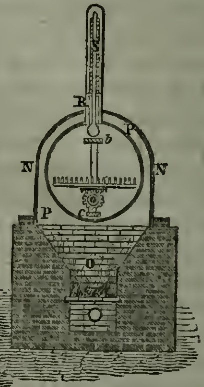


Fig. 5, represents, in perspective view, an oven and furnace intended for the tempering of common axes, but which will also serve for edge tools, swords, and cutlery of all kinds; and fig. 6, is a vertical cross section of the same. N, is the oven, set immediately above the furnace O, the heat from which passes through the flue-space P, P, surrounding the oven; Q, is the escape-flue for the heated gases; R, is an open tube leading from the interior of the oven to the external air, and through this a thermometer is passed, in such a manner that its bulb shall indicate the temperature of the air within the oven; S, is a thermometer placed within this tube; T, is a blast-pipe, through which air is to be conveyed to the ash-pit of the furnace, from any convenient blowing apparatus, and from this the tube U, leads into the ash-pit, to supply the air necessary to combustion. V, is a tube leading also from the tube T, into the oven; and through which cold air may be blown, when the temperature of the oven is to be reduced; or the same may be effected by other modes, as by the opening of the door, which has been found sufficient in practice. The tubes U, and V, are furnished with stop-cocks, to regulate the passage of air through them. This mode of tempering will apply equally to tools which have been hardened, whatever may be the process of hardening. W, is a horizontal wheel, fixed on an axis X, and made to revolve by means of bevel gearing, as shewn at Y; the axis and winch Z, serving to communicate the desired motion. *b*, and *c*, are bars placed within the oven, and made fast to its ends to sustain its axis X.

When axes are to be tempered, they are passed into the oven through the door-way, and placed on their heads, around the wheel W, which may be furnished with projecting pins, to keep them in their place. When properly arranged on the wheel W, the door is closed, and the wheel is made to revolve slowly. During the operation, there will be a continuous current of air passing out through the tube R; which current will cause the thermometer, contained in the tube, to shew the exact temperature of the air within the oven. With the best cast steel, a temperature of 510° of Fahrenheit's scale has been found to produce a perfectly good result in the tempering of axes; and the time required to bring them up to this degree of heat is about 45 minutes. For smaller articles, less time will be required, and that in proportion to their substance. The inventor states that no injury has been found to result from keeping the articles longer in the oven than is actually necessary, when the temperature was maintained at the same degree; a thing in which there is not the slightest difficulty, under the foregoing arrangements. It will be manifest, also, that the temperature of the oven may be graduated, so as to suit high or low steel, as well as to adapt it to the degree of hardness required in the articles operated upon. This process is entirely free from the uncertainty resulting from the test of color, so generally relied upon; and also from the varying fusibility of metallic alloys which have sometimes been used for tempering.

The oven, as above described and represented in the drawing, is constructed of iron, and for those of a small size, it may be best to form them of this material; but they may be constructed, also, in whole or in part, of brick or stone, which are bad conductors of heat; and their form may be varied in any convenient manner. If built entirely of bricks, or other bad conductor of heat, it may be found advisable to introduce heated air, by means of air-tubes passing through the furnace, as well as to provide the means of introducing cold air: this and other changes in the arrangement of the parts, may be made according to the choice or judgment of the constructor.

The patentee claims, First,—the manner herein set forth, of constructing the heating furnace with an enclosed fire, and having four, or any other convenient number of fire-chambers, arranged circularly around or under the top of a table, which is adapted to receive the articles that are to be heated upon it, and which is made to revolve during the time of heating, substantially in the manner and for the purpose herein set forth. Secondly,—in combination with the heating-oven, the apparatus herein described, for hardening the article thus heated; the said apparatus consisting of a revolving wheel, situated above the surface of the hardening liquid, which wheel is furnished with pins, hooks, or other devices, suited to the particular articles to be operated upon; the whole being arranged substantially as described. And, Thirdly,—the manner herein set forth of tempering articles, formed in whole or in part of hardened steel, by the action of air, heated to the requisite temperature within an oven, by means of a suitable furnace; which oven is provided with the means of ascertaining and regulating the temperature of the air, as described.—[*Inrolled March*, 1847.]

Lon. Jour. Arts & Sci.

Specification of a Patent granted to Baron Charles Wetterstedt, *of the county of Middlesex, for Improvements in the manufacture of Sheet-metal, for Sheathing and other purposes, in preventing the Corrosion of Metal, and in preserving Wood and other materials.*—Sealed 3rd November, 1846.

The first part of this invention consists in manufacturing lead, combined with a small quantity of antimony, into sheets for various purposes. The lead is melted, and regulus of antimony is added thereto in the proportion of from one to two parts, by weight, to one hundred parts of lead; the mixture, after being well stirred and skimmed, is run off and rolled out into sheets. The patentee says that he is aware that lead and antimony have been before combined together; he does not, therefore, claim the same generally; this part of his invention consisting merely in combining antimony with lead in such proportions as will allow of the compound being rolled into sheets.

The second part of this invention consists in manufacturing copper, combined with a small quantity of antimony, into sheets for various purposes; and in combining certain other metals together, and rolling them into sheets. The patentee adds to every two hundred pounds of copper in the refining furnace, when it is ready to be run out, about one pound of regulus of antimony, and two or three pounds of calcined soda, heated to nearly the melting point; the metal is well stirred and skimmed, and then it is run into moulds, and afterwards rolled. In carrying out the second improvement, the patentee employs two furnaces, placed side by side, one containing refined copper (prepared as described in the preceding improvement, or refined in the usual way), and the other Muntz's patent yellow metal; an iron mould, coated with clay and sand, is made red hot, and into it is poured one part of copper to four or five parts of yellow metal; but previous to the yellow metal being poured in, a small quantity of melted tallow is sprinkled over it, with a brush, for the purpose of cleaning it; the yellow metal is then poured in, and the whole mass is in a fit state for rolling into sheets. If preferred, brass may be substituted for the yellow metal. The same process may be employed for producing a combination of lead and tin; the two materials being used in the proportion of four or five parts of lead to one of tin or tin and lead combined.

The third part of this invention consists in certain methods of preventing the corrosion of metals and preserving wood and other materials.

A paint, for effecting these objects, is prepared by melting two or three parts of copper with one part of regulus of antimony, and running the mixture into water; after which it is dried by a gentle heat; then two parts of oxide of copper are added, and the whole is ground; the mixture being moistened during the operation of grinding with as much naphtha as will bring it to a thick pasty state. The metallic composition thus made is reduced to the required consistence, in order that it may be used as paint, by the addition of a solution composed of tar and naphtha in equal parts. When preparing paints in which zinc or lead is to be employed, the patentee uses antimony in the proportion of one and a half parts to one part of zinc or lead ; and when tin is employed, the relative proportions should be two parts of antimony to one of tin. These materials are melted together, run into water, and ground, as above described (the oxide of copper being omitted) ; and they are brought to the required consistence by the addition of oil and turpentine and suitable drying ingredients, or of the solution formed of tar and naphtha, before mentioned.

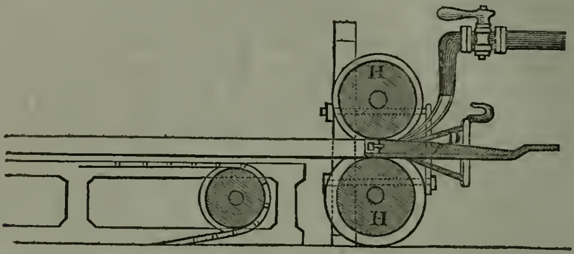
Another composition or paint, which may be applied to the metal, wood, or other material, previous to its being coated with the above paints, or which may be used alone as a preservative, is made by melting together thirty pounds of tar, thirty pounds of pitch, twenty pounds of dried soot, and four pounds of tallow or sperm oil ; a sufficient quantity of naphtha being added to bring the mixture to a suitable consistence.

Another plan for preventing corrosion is by immersing sheets of copper and zinc and copper and zinc nails in a solution composed of muriatic acid of commerce sixty pounds, oxide of copper or old copper ten pounds, and regulus of antimony three pounds; the sheets and nails being allowed to remain for two or three days in the solution, which is to be kept at a temperature of not less than 70° Fahr.

The patentee claims, Firstly,—the mode of manufacturing sheet-metal by combining lead and antimony. Secondly,—the mode of manufacturing sheet-metal by combining copper and antimony ; also the mode of combining copper and yellow metal, to be afterwards rolled into sheets of sheathing, and for other purposes ; also the mode of manufacturing sheet-metal by using lead and tin ; also the treating of sheet metal and nails as above described. Thirdly,—the modes of preparing or combining materials to be employed as paint for the prevention of corrosion of metals, and also for the preservation of wood and other materials.—[*Inrolled May*, 1847.] Ibid.

Specification of a Patent granted to James Roose, *of Darlaston, of the county of Stafford, Tube manufacturer, for certain Improvements in Welded Iron Tubing.*—Saeled August 29, 1846.

The improvements consist, first, in taking a strip of iron of the required length, breadth, and thickness, according to the size of tube, and beveling or chamfering the two edges of the lap joint, as is well understood amongst tube manufacturers ; then turning the two sides of one end of the skelp or strip when at a red heat, the two edges curling towards each other, and one lapping under the other, so that the first end is made smaller than the size of the tube when finished ; the skelp, or partly turned and partly flat strip, is then put into the furnace, and when brought up to a welding state, it is introduced into a bell or mouth-piece, D, similar to that shown in the engraving, and the turned-up end is sufficiently inserted through the bell and between the rolls, H, H, to allow the plyers on the drawbench to catch hold of the end of the skelp; the chain being then set in motion, the skelp will draw through the bell, and, owing to the ridge on the bell, the one end of the skelp will be caused to overlap the other edge, and when it has left the bell, and it is in the pinch of the rolls, the place of contact of the rolls being the point which gives the welding pressure, the mandril being within, and offering resistance to the internal part of the tube. Between the back part or small end of the bell, and the entrance of the rollers, there is a tube, *c*, through which is conveyed either hot or cold blast, blown by the engine; the end of this tube is fixed over the seam of the skelp or tube. The blast will have the effect of reducing the metal at the seam or joint into a partly liquid state, or state of fusion. The rods revolve by machinery, and traverse at the same surface speed as the chain on the drawbench, so that the draft on the tube is eased, and the draft has not a tendency to stretch the tube more in one place than another, nor to pull the tube in two. The mandril is placed in front of the bell, the bulb protruding through and into the groove of the rolls. By this process, the skelp, with the one end turned up, is produced at one heat, and at one operation, into a lap-joint welded iron tube. This process will be found most advantageous in the production, particularly of lap-joint iron tubes, on account of the small quantity of hands required, the very great facility it offers in their production, and the superiority of the articles produced. They will be found to stand a greater pressure on the inch, according to the substance of metal, than other similar tubes produced by any of the other known processes, on account of the properties of the iron being retained, the tube only having been heated once. By other processes the tubes are repeatedly heated in the furnace, which tends to destroy the fibres of the iron. Another very great advantage resulting from this process, is in the blast playing on the seam or joint of the tube before it goes under the welding pressure, so that in all cases dependence may be placed on the joint being in a good welding state, which joint might in some degree have got chilled in the bell or mouth-piece, in the bending.—[*Inrolled February* 27, 1847.] Civ. Eng. & Arch. Jour.



Specification of a Patent granted to Godfrey Woone, *of the county of Middlesex, for certain Improvements in the Art of Engraving in Relief.*—Sealed 11th March, 1846.

This invention consists in certain improvements in the formation of engraved surfaces, having the character of wood engravings or types, and applicable to the production of prints and illustrations of books, and to the printing of paper-hangings, cotton, silk, and other fabrics; the impressions presenting the appearance of tinted copper or steel-plate engravings, or tinted lithographs.

These improvements are classed under three heads, viz., first, the direct modes of engraving, or those by which the engraving is formed directly upon the plate from which the impressions are to be taken; secondly, the indirect modes, or those by which an engraving in relief is obtained on some material or substance that is not sufficiently hard to print from, and is therefore used as an original to take casts from, fit for printing; thirdly, the intaglio mode, or that by which the printing surface is obtained from a mould in a substance coming under either the first or second of the above heads.

Under the first part of the invention five new kinds of tools are described, and certain methods of breaking up the etching ground are explained. The first tool is made by taking a steel plate, one-fourth of an inch thick, and laying on it a mezzotinto ground; the second tool consists of a steel plate, on which an aquatinto ground is bitten, in such a manner that, if printed from, it would yield impressions entirely black; the third tool is formed by "machining" two sets of lines diagonally across a copper plate, at right angles to each other, and biting in to a considerable depth, so as to leave a surface of dots; the fourth tool is made by taking from the last-mentioned plate an electrotype cast, one-fourth of an inch thick, the surface of which will present the appearance of a square net-work; and the fifth tool consists of wire-gauze:—for a medium ground the gauze should be about eighty squares to the inch. The patentee says that these tools have never before, to his knowledge, been used for a similar purpose; and he therefore claims the right of using them in the ordinary process of copper-plate engraving.

The mode of employing these tools is as follows:—Upon a copper plate, of the required size, an ordinary etching ground is laid, and the patentee, having selected one of the tools (which he slightly rubs with black lead, to prevent adhesion), places the etching ground side of the plate and the prepared side of the tool in contact, and passes them through a copper-plate press; on carefully separating them, the etching-ground will be found to be broken up into infinitely small particles; and a tracing of the design is then made upon it, in the usual manner. The parts intended to print entirely black are now covered, by means of a camel's-hair brush, with a mixture of Brunswick black and spirit of turpentine; and when this is dry, the plate is placed in the decomposition cell of a galvanic battery;—the patentee does not lay claim to any novelty in this part of the process, but to the means he employs for localizing the decomposing galvanic action, and producing thereby new and peculiar effects. The plate is to remain in the cell from five to twenty minutes, according to the intensity of the action and the depth required. When the unprotected parts are slightly indented, they will form the next dark shade to black; the plate is then to be taken out, washed, and dried, and those parts of the design which are to be of this shade are covered with the above-mentioned stopping-out mixture, and the plate is replaced in the cell, and retained there for a sufficient time to produce the next shade required; these operations are repeated for every variety of shade intended to be given to the picture. A very fine effect, in imitation of tinted lithography, is stated to be produced by drawing the whole subject in at once to print in black lines, scraping or removing with a point the lines or part desired to print white, and subjecting the plate to the galvanic action until a middle or medium tint between black and white is obtained. Plates of any metal liable to galvanic decomposition may be treated according to this part of the invention. The plates, when finished, are fastened on blocks of wood of a suitable height to enable them to be worked with printing types.

The second direct method consists in reversing the ordinary mode of stipple engraving. The patentee says that he finds this mode capable of producing engravings in relief with great delicacy, especially if employed in conjunction with the other methods constituting this invention.

The indirect modes of producing engravings in relief are as follow:—One of the tools above described is heated, and upon it white wax is spread, so as to produce an even surface, by filling up all the rough or uneven parts; on this, the design is traced, and the subject is drawn with a mixture of vermillion and gum-water; when dry, turpentine is employed to remove the ground, except where protected by the vermillion, which is afterwards to be washed off with water. A cast taken from such a prepared plate will produce black lines on a middle tint; and nothing further remains to be done but to engrave any light lines or spaces required. Originals to cast from, or surfaces which may be employed at once to print from, may be made by covering a lithographic stone with an etching ground, and breaking it up by one of the tools above described; the drawing must then be proceeded with in the same manner as under the first mode, but instead of the galvanic operation it will be necessary to employ acid.

The third part of this invention, or the intaglio mode, consists in throwing a middle tint entirely over grounds in the methods lately introduced of producing a printing surface in relief, by casting or taking an electrotype impression from moulds formed by drawing or etching through a composition down to a base of metal: this may be done by machining lines entirely across the plate, or employing one of the before-mentioned tools for throwing a tint over the entire plate.—[*Inrolled, September,* 1846.] Lon. Jour. of Arts & Sci.

Specification of a Patent granted to GEORGE FREDERICK MUNTZ Esq., *of Ley Hall, near Birmingham, for an improved manufacture of Metal Plates for Sheathing the bottoms of Ships or other Vessels.*—Sealed 15th October, 1846.

This invention relates to the sheathing metal described in the specification of a patent granted to the present patentee, October 22, 1832, which metal is composed of copper and zinc, in such proportions, that, whilst the copper is to a considerable extent preserved, sufficient oxidation is produced, by the action of the sea-water on the metal, to keep the ship's bottom clean; sixty parts of copper are used in this mixture to forty parts of zinc; and it has been found, that this pro portion of copper could not be reduced without exposing the alloy to injury, from the zinc being separately acted on. The present improvements consist in combining a suitable metal or metals with the copper and zinc, so that the mixture may contain a less proportion of copper than that above named; and at the same time a sufficient degree of oxidation may be produced; and a separate action on the zinc prevented.

The patentee describes an alloy of copper and zinc with another metal, which he has found to possess the same properties of oxidation as the metal described in his former specification, and yet with an important reduction in the quantity of copper employed, and, consequently, in the cost of producing the metal. The alloy consists of fifty-six parts of copper, forty and three-quarters of zinc, and three and a quarter of lead; and, in making the alloy, the patentee uses an additional quantity of zinc, on account of the loss of that material which occurs during the operation, so as to obtain an alloy containing the different metals in the above proportions. The lead is said to act a very important part in the alloy, as, without it, the combination of fifty-six parts of copper with forty and three-quarters of zinc, would not produce an alloy which would oxidize sufficiently to keep the ship's bottom clean. The alloy, after being cast into ingots, is rolled into sheets (by preference, at a red heat), which are then to be annealed; and, if desired, the sheets may be cleaned with a mixture of sulphuric and nitric acids, properly diluted.

The patentee does not confine himself strictly to the above proportions, for the quantity of copper may be increased (which will, however, increase the cost of the sheathing metal), or it may be decreased to a slight extent; but it must not be reduced to fifty per cent. of the alloy produced. Although lead is mentioned in the above description, any other suitable metal may be used in place of it, but not with equal advantage.

The patentee claims the manufacture of sheathing metal, by so using other suitable metal or metals, when copper and zinc are combined for the purpose of sheathing, as to allow the mixture to contain a less proportion of copper than about sixty parts of copper and forty parts of zinc, and at the same time attain a sufficient degree of oxidation, and prevent separate action on the zinc.—[*Inrolled, April,* 1847.]

Ibid.

Specification of a Patent granted to RICHARD ALBERT TILGHMAN, *of London, for Improvements in the manufacture of certain Alkaline Salts.*—Sealed February 1, 1847.

To all to whom these presents shall come, &c., &c.—My invention consists in a method of obtaining the sulphate, muriate, and chromate of potash from the felspars containing that alkali. The felspars best for the purpose are those containing the largest quantity of potash, and the proportions of materials directed to be used in the different processes hereafter described, are calculated for a felspar containing sixteen per cent. of potash. I obtain sulphate of potash by heating together at or above redness, a potash felspar, lime, or its carbonate, and the sulphate of either lime, baryta, or strontia, and afterwards lixiviating the mixture with water. I have the materials ground to fine powder, and mix them intimately in the proportion of two parts by weight of felspar, one part of lime, or an equivalent quantity of carbonate of lime, and one part of sulphate of lime, which I prefer to the other sulphates. I place the mixture upon the hearth of a reverberatory furnace, and heat it to bright redness for about eight hours, turning the charge from time to time, so that all parts may receive equal heat. Although the formation of sulphate of potash is most rapid at a high temperature, yet I do not let the heat rise high enough to cause the fusion or agglutination of the mass, as the subsequent extraction of the salt by water is thereby rendered more difficult. The presence of a deoxidizing atmosphere in the furnace being injurious to the formation of the sulphate of potash, I admit through suitable openings above the level of the fire a sufficient quantity of air into the gases rising from the fuel, to preserve the atmosphere in an oxidizing state. When all the parts of the charge have remained at a high red heat for from eight to ten hours, I withdraw the charge from the furnace and lixiviate it with hot water repeatedly, as some of the salt adheres obstinately to the sulphate of lime. The solution of sulphate of potash is then evaporated, the sulphate of lime, which deposits during the evaporation, being continually removed. When the sulphate of baryta or strontia is used, in place of the sulphate of lime, the same process is to be pursued, but the extraction of the sulphate of potash by water is more easy, owing to the less solubility of the sulphates of baryta and strontia. When a cheap and abundant supply of sulphurous acid gas can be obtained, as from the roasting of sulphurous ores, the use of the sulphate of lime or other sulphate in the mixture may be dispensed with, by doubling the quantity of lime or of carbonate of lime before prescribed, and exposing the charge, while at a red heat in the furnace, to a current of sulphurous acid gas and air, with frequent stirring, sulphate of lime is thus formed during the process, and the formation of sulphate of potash takes place as in the former case.

I obtain muriate of potash, by heating together a potash felspar, and the muriate of either soda, lime, or iron, at a temperature above the fusing point of the muriate employed. I prefer using muriate of soda, or common salt, which I mix with an equal weight of finely-ground felspar. The mixture is well dried and introduced into a horizontal iron cylinder, with an opening only at one end, which is closed with an iron door or cover and luted tight. For the escape of any gas that might tend to burst the cylinder, I have a small hole through the upper part of this door, which is closed at pleasure by a loosely fitting plug. The cylinder is covered on the outside with firebrick, to protect the iron from the action of the fire. The cylinder and its contents are to be heated to bright redness for about six hours; the heat should be above the fusing point of the muriate employed, but I prefer to keep it below the temperature at which the felspar would melt, as the charge would then be more difficult to remove from the cylinder. The cover is now taken off, and the charge raked out as quickly as possible into an iron pot, which is immediately covered, and kept closed until the mass is cool. The soluble salts are to be extracted from the mass by water, and the muriate of potash separated from the other salt by evaporation and crystalization in the usual manner.

The same process is pursued when the muriate of lime or iron is employed.

I obtain chromate of potash, by heating to bright redness for several hours in an oxidizing atmosphere, an intimate mixture of finely-ground potash felspar, lime, and chrome ore. The materials are ground to fine powder, and mixed in the proportion of four parts by weight of felspar, four of lime, or an equivalent quantity of carbonate of lime, and one of chrome ore. I spread the mixture on the hearth of a reverberatory furnace, and keep it at a bright red heat for from eighteen to twenty hours, stirring and turning it over frequently, so that all parts may be equally exposed to heat and air. As with the sulphate of potash, an oxidizing atmosphere is preserved by the admission of sufficient air into the chamber of the reverberatory furnace, the heat should not be permitted to rise high enough to cause even incipient fusion in the charge, which should be kept in a porous state. When an examination of the charge in the usual manner shows that it contains the proper quantity of alkaline chromate, it is withdrawn from the furnace, and lixiviated with water as in the common process.

I claim as my invention the manufacture of sulphate of potash, by heating at or above redness, a mixture of potash felspar, lime, and the sulphate of either lime, baryta, or strontia.

I also claim the manufacture of muriate of potash by heating together a potash felspar, and the muriate of either soda, lime, or iron, at a temperature above the melting point of the muriate employed.

And I also claim the manufacture of chromate of potash, by heating to redness a mixture of a potash felspar, lime, or its carbonate, and chrome ore, all in fine powder in an oxidizing atmosphere.—[*Inrolled July* 31, 1847.]

Rep. Pat. Inv.

Specification of a Patent granted to Richard Albert Tilghman, *of London, for Improvements in the Manufacture of certain Acids, Alkalies, and Alkaline Salts.*—Sealed February 1, 1847.

To all to whom these presents shall come, &c. &c.—My invention consists in a method of obtaining certain acids, alkalies, and alkaline salts, by exposing, at a high temperature, certain salts containing such acids and alkalies to the action of steam or vapor of water, by which the acid is carried off and the alkaline base either remains free, or enters into combination with some third substance provided for that purpose. To obtain sulphuric and sulphurous acids I prefer using sulphate of lime, and I perform the operation in the following manner:—I have a fire-clay cylinder, of close texture and of any convenient size, placed vertically in a furnace, and provided with openings at the top and bottom for charging and discharging, which openings are capable of being closed air tight. To the top of this cylinder I adapt an escape tube of fire-clay for conveying off the acid vapor; and to the bottom, for the admission of the steam, I adapt another clay pipe connected with a steam boiler by a series of fire-clay tubes. In order to diminish the corrosion of the cylinder by the sulphate of lime or the lime itself, I line it with a coating of native carbonate of magnesia, applied in a similar manner to the usual clay linings of chemical furnaces. I fill the cylinder with pieces of sulphate of lime, about one quarter of an inch in diameter, and having luted the openings air tight, I heat the cylinder and its contents to a high red heat. I then pass steam from the boiler through the red-hot clay tubes into the bottom of the cylinder and up through the charge. The heated steam on its passage through the pieces of sulphate of lime carries off the acid in the state of sulphurous acid and oxygen, with sometimes a little sulphuric acid mixed with it. The acid vapors pass off by the escape tube at the top of the cylinder, and I convey them by stoneware tubes into a leaden chamber in order to combine them into sulphuric acid by the usual means. I take care that the heat is not raised so high at first as to melt the sulphate of lime in the cylinder, but I increase it towards the end of the operation, the charge becoming more infusible when partly decomposed. I have an opening in the tube conveying off the acid vapors from the top of the cylinder, by means of which I examine the vapors from time to time, and from the relative acidity of these, ascertained by the usual tests, I judge of the progress of the operation. I regulate by a stop-cock the quantity of steam passed through the charge in the cylinder, maintaining the supply at that point which produces the greatest quantity of acid in the vapors. When the vapors cease to contain any notable proportion of acid, the cylinder and its contents being at a high red or low white heat, I shut off the steam, withdraw the charge from the cylinder by the lower opening, and put in a fresh one to be treated like the first. The charge thus operated upon will be found to consist chiefly of caustic lime. When I wish to obtain the acid and alkaline base from the sulphate of magnesia, I first drive off by heat all its water; I then introduce it in small pieces into a cylinder such as I have before described, and operate upon it in the manner directed for the sulphate of lime. But I take care to keep the heat at low redness at first to prevent the fusion of the charge, which would choak up the cylinder and prevent the passage of the steam. The decomposition of sulphate of magnesia takes place at a much lower temperature than that of sulphate of lime (a low red heat is sufficient), and a considerable part of the acid is given off in the state of sulphuric acid. When the charge has been treated as directed, the residue will be found to consist chiefly of caustic magnesia. When I wish to decompose the sulphates of baryta and strontia, I operate upon them in a reverberatory furnace. This mode is less advantageous for the manufacture of sulphuric acid than the use of the close cylinder formerly described, but I prefer it for the two last-mentioned salts, because I consider their bases the more important product of their decomposition, and the hydrates of these alkalies, and particularly that of baryta, being fusible, would have much tendency to corrode the interior of the cylinder at the heat necessary to decompose the salts. I use a common reverberatory furnace heated by a coke fire with its hearth covered with a compact bed of native carbonate of magnesia three or four inches thick. Several clay steam-pipes are introduced through the roof of the furnace so as to throw a current of heated steam over the whole width of the hearth; these pipes are connected with a steam-boiler by a series of fire-clay tubes kept red hot.

The sulphate, broken into pieces of about half an inch in diameter, is spread over the lining of carbonate of magnesia on the hearth of the furnace and brought to a high red or low white heat. A current of steam is then admitted from the boiler through the red hot tubes upon the charge. The acid of the sulphate is carried off by the steam, and, when I wish to collect it, the acid vapors are conveyed along with the gases of the fire into a leaden chamber to be combined into sulphuric acid by the usual means. The quantity of steam thrown upon the charge is kept at the point which produces the most rapid evolution of acid, and the charge is stirred occasionally so as to expose fresh surfaces to the action of the steam. As the contact of deoxidizing gases with the sulphate is injurious, I admit, if necessary, by suitable openings above the fuel, such an excess of air as will render the atmosphere in the furnace oxidizing. The sulphate of strontia requires a higher heat than the sulphate of lime for its decomposition, and the sulphate of baryta still higher than the sulphate of strontia. When the sulphate of baryta is partly decomposed, the mass melts and becomes more fusible as the decomposition proceeds. I judge of the progress of the operation by testing a portion of the charge from time to time; when it dissolves altogether, or nearly so, in dilute nitric acid, I withdraw the charge, which now consists chiefly of the hydrate of baryta or strontia. To obtain muriatic acid and the hydrates of baryta or of strontia, or caustic lime, from the muriates of those bases, I employ the same process as that above described for the decomposition of the sulphate of baryta. The sulphates of potash and soda may to some extent be decomposed by being subjected at a high temperature to the action of a current of heated steam in the manner directed for the decomposition of the sulphate of baryta. But owing probably to the volatile nature of the bases of these salts at a high temperature, no large proportion of them can thus be obtained in a free state. To aid, therefore, the decomposing action of the steam, I employ some substance capable, when mixed with these sulphates highly heated and exposed to steam, of forming a combination with their alkaline bases, which shall yet when cold give up the alkali to the action either of water, or of water and carbonic acid. Of the large class of substances possessing these properties, which for convenience I will call combining substances, I prefer to use either alumina or the subphosphate of alumina. The alumina is prepared by strongly igniting the sulphate of alumina or by any other well known process.

The subphosphate of alumina is prepared (as is directed in chemical works) by mixing solutions of the phosphate of soda and the sulphate of alumina, and adding to the solution a slight excess of ammonia. I mix the alumina in the state of powder with an equal weight of the sulphate of potash or of soda, also powdered, and spread the mixture upon the hearth of a reverberatory furnace such as I have before described for the decomposition of the sulphate of baryta. The mixture is then heated, exposed to steam, stirred, and the operation conducted in all respects in the manner described for the treatment of the sulphate of baryta. When a specimen of the charge shows by the usual tests that it contains no notable proportion of the sulphate undecomposed, the operation is completed.

I then withdraw the charge, lixiviate it with hot water, and when the clear solution of aluminate of potash or soda thus obtained has become cold, I pass through it an excess of carbonic acid until no more precipitate of alumina is formed; the clear solution of carbonate of potash or soda is then drawn off and evaporated. The alumina thus recovered is again used as the combining substance. When I wish to obtain the aluminate of potash or of soda, I merely evaporate the solution above described without introducing the carbonic acid. The muriate of potash or of soda may also be decomposed when in a fused state by the joint action of alumina, or the subphosphate of alumina and steam; the operation is to be conducted in all respects in the same manner as that just described for the sulphates of potash and soda. But owing to the great volatility of the muriates of potash and soda when exposed at a high temperature to a current of air or steam, a large quantity of the muriate will escape with the steam and gases of the fire in the state of vapor undecomposed, and will be lost or will be difficult to condense. I prefer, therefore, to effect the decomposition of the muriates of potash and soda by causing their vapors, intimately mixed with highly heated steam, to pass slowly through a mass of small pieces of alumina kept at a high red heat. I use for this purpose a vertical fire-clay cylinder lined with a coating of native carbonate of magnesia to diminish the corrosion of its sides by the alkali, and made with convenient openings at top and bottom for charging and discharging, which openings should be capable of being closed air tight.

I arrange a cast-iron retort so that its tube enters directly the cylinder near its bottom. The retort should have a charging door at the top capable of being made air-tight, through which is introduced the muriate of potash or soda to be decomposed. The muriates of potash and soda will not vaporize freely, even when fused and highly heated, unless the atmosphere above them is continually changed. This may be effected by a current of steam, and I find that I can sufficiently regulate the quantity of the salt volatilized from the retort by the amount of steam which I blow over its melted surface. I therefore insert a small steam pipe into the top of the retort so as to throw a jet of heated steam upon the surface of the melted salt, and thus force its vapor to enter the cylinder. The quantity of steam thus introduced to aid the volatilization is not sufficient to decompose all the salt volatilized. The rest of the steam necessary for this purpose is passed directly into the cylinder by a fire-clay pipe entering it near the bottom and connected through a series of fire-clay tubes kept red hot with a steam boiler. Both steam pipes are provided with cocks. An escape tube is inserted into the top of the cylinder to convey the acid vapor and the vapor of any undecomposed muriate into suitable condensers. I have an opening in this tube by which I can withdraw at times a portion of the vapors in it to examine their saline and acid character. The cylinder and retort are to be so constructed and arranged as to allow their contents to be heated to high redness and upwards by any of the well known means. The manner of operating is as follows:—The discharging door being closed air-tight, I fill the cylinder with alumina in pieces of about one-quarter of an inch in diameter, and fill the retort with the muriate of potash or soda and then close both the charging-door of the cylinder and that of the retort air tight. I now bring the cylinder to a high red or white heat, and the retort to a cherry red heat, so that the salt in it is melted and ready to volatilize freely on the admission of the steam upon its surface. Steam is now passed from the boiler through the red hot tubes into the cylinder by the pipe entering near its bottom, so that it is filled with highly heated steam passing upwards in a slow current through the interstices of the pieces of alumina. I now admit by degrees a jet of heated steam into the salt retort by the pipe entering its top, and thus drive a quantity of salt vapor into the cylinder, where it mixes thoroughly with the current of steam which has entered by the other pipe, and ascends with it through the column of highly heated alumina. In its passage the alkaline base of the muriate combines with the alumina, forming an aluminate of potash or soda, and the muriatic acid, together with any of the salt vapor which may have escaped decomposition, passes off with the steam through the escape tube at the top of the cylinder into the condensers provided. The progress of the operation can be ascertained by examining the nature of the vapors which are passing through the escape tube. When these vapors contain a large quantity of salt and are strongly acid at the same time, I admit more steam through the pipe leading directly into the cylinder, and if this does not have the effect of diminishing the quantity of salt in the vapors, I lessen the quantity of steam thrown into the salt retort, and by that means decrease the supply of salt vapor driven into the cylinder. When the escaping vapors contain but little salt, and a large quantity of acid, I consider the operation as proceeding favorably, and I always endeavor to regulate the quantities of steam passed through the two pipes, and by that means the proportions of salt vapor and steam thrown into the cylinder, so as to produce this effect. When the escaping vapors contain a large quantity of salt and steam and but little acid, the cylinder and its contents being at a high red heat, I consider that the decomposition of the salt is no longer effected in the cylinder, and I then shut off both currents of steam, withdraw the charge by the lower door, and replace it with fresh alumina. The withdrawn charge is then lixiviated with hot water, and the solution of aluminate of potash or soda thus obtained is treated with carbonic acid as before described. The lining of the cylinder should be examined occasionally and kept in repair, so that the fire clay may not be corroded by the alkali. Provided the charge of alumina in the cylinder is readily and equably permeable to the current of steam and salt vapor, the smaller the pieces of which it consists, and the greater the surface they expose to the current, the more rapidly will the decomposition of the muriate proceed. The steam used need not be of higher boiler pressure than will suffice to secure its passage through the charge in the cylinder. The subphosphate of alumina may be substituted for the alumina in the processes for the decomposition of the sulphates and muriates of potash and soda, and its action is even more powerful, but its first cost is greater. Although, to aid the decomposition of the sulphates and muriates of potash and soda by steam, at a high temperature, the use of either alumina or its subphosphate is preferred as the combining substance; yet there are a great number of substances which also possess the requisite properties, but act with various degrees of energy. Thus, many salts which already contain a certain proportion of base, will yet, when exposed in contact with the sulphates and muriates of potash and soda at a high heat to the action of steam, form a combination with the potash or soda decomposable, when cold, by water, or water and carbonic acid. The subphosphates of lime, baryta, and strontia, and the subsilicates of lime, baryta, and strontia, will, under these circumstances, combine with the alkali, and yield it to the action of water alone when cold. The sulphates of baryta and strontia, although themselves decomposable by the action of steam, at high temperatures, are still capable of thus aiding in the decomposition of the sulphates and muriates of potash and soda, and yield the alkali by the action of water. The neutral phosphates and neutral silicates of potash and soda when thus treated form basic salts, which are soluble in water, and then decomposable by carbonic acid. The alkalies, lime, and magnesia will also thus combine with a portion of free potash or soda, which may be extracted by water. Other materials are capable of being used as combining substances, but I have named those which I consider preferable.

The decomposition of the muriate of soda by the action of steam, at a high temperature, may be applied to the production of soda in another way, videlicet, by exposing the muriate, mixed with sulphate of lime, to a high heat, and to the current of steam, and afterwards decomposing the sulphate of soda thus formed by the usual mode. For this process I use a horizontal cylinder, of close fireware, protected on the inside from the action of the lime and sulphate, by a lining of carbonate of magnesia, and provided with an opening for charging capable of being made air-tight. Into the top of the cylinder at one end a steam-pipe is introduced, and from the other end at the top, an escape-pipe connects, with suitable condensers, for collecting the vaporized salt and acid. The cylinder is half filled with a mixture of equal parts, by weight, of sulphate of lime and muriate of soda, the opening made tight, and the cylinder and its contents brought to a red heat. A current of heated steam is then admitted, which passes over the surface of the melted mixture, and carries off muriatic acid, with more or less volatilized salt into the condensers. When the steam escaping from the cylinder ceases to contain any notable quantity of muriatic acid, the operation is discontinued, and the charge is withdrawn. Its soluble salts are extracted by water, and the sulphate of soda separated from any undecomposed muriate by evaporation and crystalization. In this operation the heat should not be raised so high as to cause the decomposition, by the steam, of the sulphate of soda produced or of the sulphate of lime itself. I obtain the chromates of potash and soda by subjecting a mixture of the muriate or sulphate of either of those bases respectively with chrome ore in fine powder, at a bright red heat, to the action of a current of steam and atmospheric air. The muriatic or sulphuric acid is carried off by the steam, and the oxide of chromium is oxidized and reacts upon the liberated alkali, forming a chromate. When the sulphate of potash or soda is to be used, I mix intimately one part by weight of ground chrome ore with two parts of the sulphate of potash or soda and two parts of lime, and heat the mixture to bright redness for eighteen or twenty hours, on the hearth of a reverberatory furnace, while currents of heated steam are thrown upon its surface from pipes coming through the roof of the furnace. The atmosphere in the furnace must always be kept in an oxidizing state by the admission of a sufficient quantity of air through openings above the level of the fuel, and the charge should be frequently stirred to expose fresh surfaces to the steam and air. The lime is not absolutely required in the above mixture, but I prefer it as aiding the action and making the charge more porous. When the charge is found by the usual tests to contain a sufficient quantity of the alkaline chromate, it is withdrawn, and the soluble parts extracted by water and treated in the usual way. When I wish to use the muriates of potash and soda for the production of the chromates of potash and soda, I mix the ground chrome ore with twice its weight of powdered chalk, moisten the mixture with water, and form it into pieces of about half an inch in diameter, which are well dried. With these I fill a cylinder, having a retort and steam-pipes attached, such as are described for the decomposition of the muriates of potash and soda by means of alumina; and I proceed exactly as in that operation, except that I insert another pipe near the bottom of the cylinder, through which I force a stream of heated air, which mixes with the ascending current of steam and salt vapor, so as to pass with them through the charge. When the nature of the vapors, escaping from the top of the cylinder, is such as I have before described, as indicating that the decomposition of the muriate ceases to be effected in the cylinder, the charge is withdrawn, and the alkaline chromate extracted by water as usual.

Though I prefer, in all the above described processes, heating the steam highly before passing it upon the salt to be decomposed, yet the same effect will be produced whenever the steam and salt are in contact at the proper temperature for the respective decompositions, whether they have both been previously heated, or one alone heated, so highly as to be able to raise the other to the required temperature. As has been before stated, some of the salts are decomposable by steam at a much lower temperature than others, but with all, the decomposition proceeds more rapidly in proportion as the heat is increased.

I claim, as of my invention, the decomposing the sulphates of baryta, strontia, lime, and magnesia, and the muriates of baryta, strontia, and lime, by exposing them at a high temperature to the action of a current of steam, for the purpose of obtaining the acids and the alkalies of these salts respectively.

I claim as of my invention the decomposing the sulphates and muriates of potash and soda, for the purpose of obtaining the acids and the alkalies of these salts respectively, by exposing them at a high temperature to the joint action of a current of steam and of alumina, or other combining substance.

I claim as of my invention the making sulphate of soda, by the combined action of sulphate of lime and a current of steam upon the muriate of soda, at a red heat.

I claim as of my invention the making the chromates of potash and soda by exposing a mixture of chrome ore, and the sulphates or muriates of those alkalies respectively, at a bright red heat, to a current of steam and an oxidizing atmosphere.

I claim as of my invention making aluminate of potash and soda, by the action of a current of steam upon a mixture of alumina and the sulphate or muriate of potash or soda, at a high red heat.—[*Inrolled July* 31, 1847.]

MECHANICS, PHYSICS, AND CHEMISTRY.

Drayton's Process for Silvering Glass.

The Western Scientific Institution, Leicester-square, London, has lately roused itself from its former torpid state, and is now making considerable efforts in the direction of general usefulness. Several of the late meetings have assumed a more stirring aspect, and good results are to be looked for from it. Among the list of the papers recently read before the members, is one by Mr. Foord, "On Drayton's method of Silvering Glass," comparing the improved plan with the deleterious and imperfect system lately pursued. The injury suffered by the workmen from the action of the mercury used in forming the amalgam, ought to be a sufficient reason for banishing the old system, were it even more economical, instead of more expensive, than the new process. A perusal of the report of Mr. Foord's practically descriptive paper below, will show that we do not magnify the evil.

The discovery of the process of coating glass surfaces with a film of metallic silver in the mirror form (the subject of the present paper), was, most probably, made at the suggestion of some accidental circumstance, and was, as a discovery, perfected in the hands of Mr. Drayton, not by theoretical reasoning, or a strictly inductive method, but by the laborious method of persevering in experiments, such as were by him, from time to time, considered most likely to yield satisfactory results. Nor do the many results thus obtained appear to have been classified or noted, and hence, when first put into the hands of the manufacturer, this discovery was neither more nor less than a perfectly new and beautiful fact, which had yet to be elaborated into a workable process, being surrounded with practical difficulties, and as yet deficient of those mechanical and other auxiliary appliances which convert the experience of the philosopher into the practice of the manufacturer—in fact, this discovery was made in exactly the same manner, and under similar circumstances, with the Daguerreotype ; and, like that process, could not, in the present state of science, have been discovered by a strictly inductive method, requiring also, like it, an uncommon description of genius, combined with the greatest perseverance for its development ; and the parallel between these two processes holds so far good that they have both passed through similar progressive steps of improvement, and have both arrived at a state of perfection in practice, while each remains without a theory. More with a view to the gratification of those interested in scientific matters, than with an idea of attracting the public attention to a new feature in commerce, this process was in a comparatively early stage of its progression towards its present perfect state, brought forward as the subject of a lecture by Dr. Faraday, on one of the Friday evening meetings, at the Royal Institution, at which time it excited that almost universal desire to become practically acquainted with its routine, which is the characteristic of what may be called popular discoveries, and which we all felt in the cases of the discoveries of Daguerre, Talbot, Spencer, and Schonbein ; and, from the time when this excitement subsided to the present, the unceasing efforts for its improvement have been gradually rewarded, until all difficulties standing in the way of its practice having been removed, it has at last become a process having many advantages over the old method of silvering mirrors, and which can be carried on at a price commanding an extensive sale. Before we can make a just comparison of these two processes, it will be necessary to consider them each as at present conducted. By the old method the reflecting metallic surface is obtained by spreading out upon a perfectly flat table of slate or stone a tinfoil of a size a little larger than that of the plate to be silvered ;

and having rubbed this foil perfectly flat, and having cleaned the glass to be silvered, with extreme carefulness, the mercury is flooded over the surface of the foil; and, before it has had sufficient time to amalgamate very deeply into the substance of the latter, the glass is slid on in such a manner as to push before it the greater part of the mercury and any particles of dust which may have collected on its surface, retaining between its under surface and the foil a stratum of mercury perfectly free from scum or any other matter which can effect its brilliancy; and, as soon as the glass is thus slid on, weights of cast-iron are placed over its entire surface, so as gradually to squeeze out the surplus of mercury—the object being to leave only the solid amalgam of mercury with the tinfoil, in contact with the glass surface; and the more effectually to drain off the mercury, the table is, after a certain time, inclined by a screw mechanism, upon its bearings, and ultimately the weights are removed, and the glass is gradually elevated to a vertical position; if the weight be removed before the mercury is sufficiently well drained off, or if the glass is elevated too quickly, the rapid draining of the mercury is accompanied by the insinuation of atmospheric air between the glass and the amalgamated foil, spoiling the result. As the presence of moisture would be detrimental, the silverer's workshop is kept at a comparatively high temperature. The mercury, which flows from the glass, from first to last, is carefully collected, a narrow gutter running round each silvering table, and the mercury thus collected retains in solution a small quantity of tin, which is found to be serviceable, by preventing its too rapid amalgamating action in future operations, which would be liable to dissolve the foil into holes, before the glass could be placed upon it. By the process in silvering concave or convex surfaces, it is necessary to make a mould of plaster of Paris, and to rub the foil with caution, until it assumes the curve of the surface of the glass to be silvered—in other respects, the method of silvering is the same as the preceding; it must, however, be observed, that if the curvature be deep, the process becomes difficult or quite impossible, and that surfaces of irregular curvature cannot, in any way, be silvered by this process. The process of Drayton is so far different from the preceding, that the only point in which they can be said to resemble each other is, that they produce a result of the same general appearance; and, as far as plain mirrors are concerned, applicable to the same purposes. By Mr. Drayton's process, two solutions are requisite, the silver solution containing in the proportion of 1 oz. of nitrate of silver; 2 ozs. of distilled water; hartshorn of the old *pharmacopœia* (a solution of carbonate of ammonia), 1 drachm; ammonia water, ½ drachm; spirits of wine, 3 ozs.—dissolving the nitrate in the distilled water, and filtering the precipitate of carbonate of silver; after the addition of the alkalies, and, before adding the spirit of wine to the solution thus prepared, a quantity of the essential oil is added, with agitation, in the proportion of 20 grains or more to each ounce of solution, the proportion of the constituents of the solution not being very definite. The solution thus prepared, gradually deposits a black precipitate, rich in silver, and as soon as it has ceased to do so, which happens after a day or two, becomes fit for use. The other solution is constituted of essential oil of cloves, dissolved in spirits of wine, in about the proportion of 1 oz. of oil of cloves to 3 of spirits of wine, but may be used with almost any proportion of spirit greater than 3 to 1; if a proportionately greater quantity be employed of the oil of cloves solution, of the proportions now given, about 20 drops are to be employed for each ounce of the silver solution. The oil of cassia appears to determine the brilliancy of the metallic deposit, which is thrown from the silver solution whenever the oil of cloves solution is added thereto, and the quantity of the oil of cloves solution determines the rapidity of the deposit and the thickness of the coat of silver. The filtering of the silvering solution must not be made through filtering paper, or any other animal and vegetable fabric, but through asbestos, or some other substance, which is without action upon it.

In applying the above principle to the silvering of plain mirrors, the glass and necessary apparatus being cleaned with the greatest nicety, and the glass being placed in a suitable trough, or vessel, is flooded over with the silvering solution, to which the proper proportion of oil of cloves solution has just been added, and is allowed to remain in such position for about three hours, at the end of which time there has been deposited upon it from the solution a film of pure silver, of the greatest brilliancy, and so extremely adhesive, that it can be perfectly removed only by the action of acids. The plate thus silvered, although it is perfect in reflective power, has yet to undergo such process, as will ensure its permanence and durability; to this purpose it is placed on an incline, and washed by repeated currents, or floodings, of distilled water—so as to remove from the back all extraneous, resinous, and other matters, products of the chemical action, to which this precipitation of the silver is due; and is then wheeled on a carriage into a kiln or oven, raised to a proper temperature, and where it remains for several hours. As soon as withdrawn, it is protected at the back by a coat of black varnish, and is then so durable, as not only to stand under all ordinary circumstances, but likewise to withstand the action of the most rigid tests that can be applied to it. Now, as this process is performed through the medium of a fluid, it happens that glass surfaces, of any curvature, can be silvered—in short, that we can silver the inside of any glass vessel, into which we can introduce the solution, even the finest capillary tubes. Now, as the silver is gradually deposited in close contact with the polished glass surface, it presents, of necessity, a counterpart surface also, of the most perfect polish; and as its metallic resplendence is entirely due to the compactness of its structure, and the perfection of this surface, it follows, that the film of silver is required to be no thicker than to be opaque—hence in this process, silver is employed at about the same cost as that of the old process, with amalgamated tinfoil. If a thick coat be for experiment thrown down, it will be found that the deposit becomes less and less compact, as it becomes more distant from the glass surface—so that at the back of the glass we find a black pulverulent sponge of metallic silver, which owes its blackness to the extreme fineness and want of aggregation of its particles. To prove that the metallic lustre is owing to the degree of compactness of the particles, it is only necessary to rub down a little of any precipitated ductile metal, either in its finely-pulverulent black state, or, that of a grey, unmetallic-looking powder, to communicate to it, by the coherence of its particles, the highest degree of metallic lustre. Without attempting any theory for this new process of silvering, it may be remarked, that the solution of silver contains also materials of a deoxidating nature, and that the addition of a solution of essential oil of cloves brings about such a change, that the silver is gradually deposited upon the sides of the vessel in which it is contained, and upon the surface of such solid substances as may be contained in it, much in the same way as a body in crystalizing does not deposit crystals equally throughout its bulk, but by preference, on the sides of the containing vessel, or upon the sticks, or strings, which have been introduced as a nucleus for their deposition. Whether the silver be contained in the solution as an amide, or in any complex organic compound, I do not pretend to offer any opinion. When Baron Liebig was in England, he appeared much interested in the process; and, so far from offering an explanation of its principle, he took away a phial of the solution for investigation, promising to write in due time respecting it; and his communication has not, up to this time, been received. In concluding these remarks, I may observe, that the compounds prescribed by Mr. Drayton, may be replaced by others of similar properties—thus, the oil of cloves may be replaced, I am informed, by oil of pimento, and, perhaps, also by such other of the essential oils as have an acid character; but, until the theory for this process be given, the limits, within which these substitutions lie, cannot be determined. To compare the new process of Drayton with the old method of silvering, it may be observed, in relation to the comparative rapidity of the processes, that by the old plan the process takes many days, the glasses draining mercury after they are fixed, unless they have been allowed to stand a sufficient time, the mercury so running off spoiling any gilt work on which it might happen to settle. By the new process the glass is returnable within 48 hours—in many cases, glasses which have been sent to the Paris depot in the morning (of which I will speak presently) for silvering, have been returned in the evening, quite dry, varnished, and in perfect condition—the silvering taking three hours, the remaining time being taken up in the kiln drying, and in allowing the two coats of protective varnish to become dry. In respect to quality, the color of the tin amalgam is a bluish-white, that of the silver coat is a purer white, which, if colored at all, approaches more to a warm tint, having a superior brilliancy and power of reflection—a difference sufficiently obvious by daylight, but more especially so by gas or any other artificial light, so much so, as to promise economy in the lighting of large apartments, decorated by mirrors of this description. In respect to comparative durability, without being too hasty in speaking positively respecting a matter of two or three years experience, I may say, that, since the process has been perfected, the most rigid tests have been applied with most satisfactory results; the mirrors have been suspended for weeks in positions in which the atmosphere has been charged with sulphuretted vapors, without suffering the least change; and those manufactured at the opening of the business, are, at this day, as perfect as those just completed—it is permanent in sunshine, and not affected in damp—may be carelessly, and even roughly, handled—and, as for the durability of the protective varnish, it has even remained in a stove at 70° Cent. (158 Fahrenheit) for 15 days, without, in any degree, suffering—not so with the old process, the amalgam being so far decomposable by the volatilizing of the mercury, that most old glasses are more or less spotted; while, in all cases, it is absolutely necessary to move a new glass, without even touching the amalgam, which adheres but slightly to the glass, so as to be displaced by the slightest pressure, rendering paneled blind frames, with flannel facings (in all large glasses especially) necessary, and so at least doubling the expense of the cost of silvering—no such blind frames being required with glasses silvered by the new method, so long as the frame is sufficiently strong to support the glass. Respecting the cost, I may mention that silvering by the new process, is at present charged at Paris at 8 per cent. on the value of the unsilvered plate. Lastly, but most importantly, it must be mentioned, that the old process is rapidly destructive of life, mercury being volatile at all temperatures above the freezing point of water, and considerably so at the high temperature of the silvering shop—these workmen live in an atmosphere saturated with mercury, and with little exercise or air soon exchange that disposition to activity, which would prompt them to cautiousness and cleanliness, for an apathy which permits the subtle poison to make, unobserved, its gradual, but not less certain, inroads upon the constitution, until the whole system is saturated with mercury, rendering the body indescribably loathsome, permanently impairing the action of the nervous system, producing involuntary motion of the extremities, and eventually a complete waste of both the mental faculties and corporeal system, terminating, after much suffering, in death. I do not know that the description which I have given is exactly such as a professional man would have furnished, but I have endeavored to describe, without exaggeration, what is constantly occurring, and what I have myself witnessed. It has been remarked, that when the workman is sufficiently careful of himself, he may remain at this employment for a long time without suffering any serious detriment to his health, and that the effects of the mercury are too often augmented by the habit of drinking spirits; but how rarely is it the case, that we find a man in such employment who has the energy of system to withstand the depressing effect of the workshop; and who can wonder that, when a man has by loss of health ceased to enjoy his existence, that he should sink into that apathetic state, which takes no precautions against the progress of the disease, and which flies to the use of spirit as a temporary stimulant (?), and, in many cases, even deceiving himself into the belief that spirituous drinks are a specific for the mercury? So far from taking precautions against it, the general practice seems to be, such as is *most certainly* calculated to bring about the effect in the most speedy manner, as much so almost as if it were devised for that purpose. The men coming to work in the morning, hang up their clothes in the workshop, to become saturated with mercury in the course of the day, and, putting them on again when leaving work, hang up their working clothes to become similarly saturated by the time they come in the morning; and so from Monday morning to Saturday night, taking their food with them to work, in their pockets, as if to saturate it also with the poison, and to prèvent them the chance of a breath of fresh air during the dinner hour. This system, however, is not to be considered as a point of negligence on the part of the men, but as a consequence of the apathetic state, the natural result of confinement in the silvering workshop. With the new process, there is no injurious exhalation whatever; the nitrate of silver solution will stain the hands if spilled over them, but, as hands stained in this manner point out the careless workmen, this point must be allowed to be an advantage, productive of dexterity and carefulness; hands so stained remain black for several days, when the skin peels off without further inconvenience; all that can be said against the spirit and the essential oils is, that they would form by their mixture liquors of too palatable a quality to be safely trusted about in their unmixed state.

In conclusion, I beg to remark that at the Paris depot, under the direction of the perfector of the process, M. G. F. Tourape, there have been silvered and sent out, in execution of orders, during the last four months, between 500 and 1000 large glasses, averaging sizes between a 100 by 66 and 36 by 27, of which a shipment of about 25 large glasses was made to China; and that the trade is now making such progress, that we may fairly expect to see it before long a matter of at least very general adoption—not only for plain mirrors, but as a new element in decorative art, and an auxiliary to optical and general science. To suggest, for example, a few of the many purposes to which this invention is applicable, I may mention, in conclusion, the covering of the unsightly iron pillars, which disfigure the appearance of shop windows, with silvered glass tubes, or columns, and lacquered brass or gilt enrichments; the fitting up of large chandeliers with vase-shaped centres of silvered and cut glass, which would produce a refulgence as yet unobtained; for theatrical purposes it would be most generally useful—for curved shop faciers, for curved panels, d combined with gilt work, crimson, and other velvets and hangings, generally for cornice poles, and general decoration. Nor would it be less useful for fancy temples, and durable centre ornaments for table decoration. Indeed, for almost all purposes of decoration it may be applied; while for silvering surgeons' specula, for looking into the air, it will be available, the depth of the curves required being greater than can be with certainty silvered by the old process, and the cost of ground metallic specula being by far too expensive for general use. In short, this process is so universally applicable, that its employment is not limited by any difficulty of silvering highly-complex forms of glass, but only where there is difficulty in fashioning the glass itself.

Prac. Mech. and Eng. Mag.

Seventeenth Meeting of the British Association for the Advancement of Science, held at Oxford, June 23, 1847.

We have prepared, for the Journal of the Franklin Institute, the following abstract of the proceedings of the British Association at its late annual meeting. Our limits will not permit an extended notice of the many interesting scientific and practical subjects which were there discussed; and while we have made extracts from the reports of such as we conceived would be of more particular interest to our readers, we have been compelled to omit much that is deserving of attention.

The General Committee met on the 23rd of June, received reports from the Treasurer and Council, and transacted other usual business. In the afternoon the General Meeting of the Association took place, when Sir R. J. Murchison, after a short address, introduced the new President, Sir R. H. Inglis, to the chair. In compliance with the usual custom, the new President, on taking his seat, delivered an address to the Meeting, in which he briefly reviewed the state and progress of science during the past year; referring particularly to Astronomy, Physiology, Etherization, Microscopic Research, Natural History, Botany, and Electro-Magnetism, as applied to Telegraphic communications. When speaking on the last-mentioned subject, he adverted to the general adoption and rapid extension of the Electric Telegraph system of communication in the United States, and expressed his feeling of regret that this great discovery had been so inadequately adopted in Great Britain.

Other meetings of the General Committee and of the Association were held for the transaction of the usual routine business.

On Thursday, June 24, the meetings of the Sections commenced; the first being that of Section A, on Mathematical and Physical Science. Of some of the papers read before this Section, we extract the following notices, as reported in the *London Athenæum:*

On the Atmosphere of the Moon, by J. Grooby.—Whether the Moon has an atmosphere or body of air similar to that which surrounds the Earth, has long been a fertile subject of dispute among philosophers, some affirming its existence and others as strenuously denying it. Some, who take the negative side of the argument, have urged in defence of their opinion, the constant serenity of the Moon's surface, always undisturbed by clouds or vapors, and even the smallest of the numerous spots or maculæ which crowd her surface being at all times equally visible. This certainly would be a very strong argument against an atmosphere were the assertions on which it is founded to be relied upon. But this does not appear to be the case; for, on the other hand, there are many astronomers who affirm that the Moon is not always equally clear and distinct. Hevelius says, that he has several times found, in skies perfectly clear, when even stars of the sixth and seventh magnitudes were conspicuous, yet at the same altitude of the Moon and the same distance from the Earth, and with one and the same excellent telescope, the Moon and its maculæ do not appear equally lucid, clear, and perspicuous at all times. He also adds, "From the circumstances of the observation, it is evident that the reason of this phenomenon is not either in our air, in the telescope, in the Moon, or in the spectator's eye, but must be looked for in something existing about the Moon, that is (I presume) in its atmosphere." Again, the existence of a lunar atmosphere has been denied because the stars, in an occultation, when just about to disappear behind the body of the Moon, retain their full lustre till they seem to touch the very edge, and then vanish in a moment, which phenomenon (it is urged) could not happen if the Moon were encompassed with an atmosphere. Here, again, the evidence of different astronomers is at variance, one party affirming and the other denying the fact. Nay, even the same individual has sometimes observed both stars and planets to undergo a change, both in brightness, form, and color, when close to the Moon's limb, while at other times he has perceived nothing of the kind. A third argument against the existence of an atmosphere (and the last I shall notice) is this. If (it is affirmed) the Moon were surrounded by an atmosphere, then the duration of eclipses and occultations ought to be diminished by means of its refractive power, and hence a celebrated French astronomer (in a Memoir written expressly on this subject), has endeavored to demonstrate that, if such an atmosphere did exist, and its horizontal refraction amounted to only 8″, there could never be a total eclipse of the Sun. But (he continues) in the eclipse of that luminary, which happened in 1724, the total darkness continued for two minutes sixteen seconds. Many eminent astronomers concur with the one I have just quoted, in denying that anything like refraction can exist, or has ever been observed to exist about the Moon's atmosphere; others, equally eminent, assert that they have observed the most unequivocal proofs of it. Both Halley and Euler speak of the evident distortion observable in the Sun's limb in total and annular eclipses. The latter, in particular, says, in the eclipse of the Sun which happened in July, 1748, he observed, that when the uncovered part of the Sun resembled the Moon in her quadrature, the horns of the solar crescent appeared to be bent outwards beyond the circle in which every other part of his disk was comprehended; and when the eclipse became annular, the Sun's disk was dilated beyond the circle which formerly embraced it. This dilatation was also observed at Frankfort, and was estimated by Euler at 25″. Here, then, we have one astronomer observing in a solar eclipse a refraction of 12½″, while another, from his observations, denies that any perceptible refraction does or can exist. From such contradictory evidence, it seems extremely difficult to draw anything like a satisfactory conclusion. The most probable one seems to be this:—That the Moon is surrounded by an atmosphere in some respects like our own, but much rarer; and that it is differently modified by the peculiar circumstances attached to it. For when we consider that from the slow motion of the Moon on its axis the principal part of its surface is exposed to the direct force of the Sun's rays for fourteen and a half days and nights, without any intermission, and then, for a like period deprived of them, the one producing a degree of cold beyond anything we can conceive, and the other, a degree of heat sufficient, probably (if there be water in the Moon), to produce a temporary atmosphere of steam,—have we not every reason to conclude that the atmosphere with which the Moon may be, and probably is, encompassed, is materially different in its constitution and properties from that which surrounds our own globe, and which may, in some degree, account for the contradictory statements I have just noticed? The annular eclipse of the Sun which will take place in October next, presents (I think) the most likely means of obtaining more accurate information on this subject than we at present possess.

On some Recent and Remarkable Examples of the Protection afforded by Metallic Conductors against Heavy Strokes of Lightning. By Sir W. S. Harris.—The possibility of guarding buildings and other structures against the destructive effects of lightning, has been made a great question in practical science—from the time of Franklin to the present day; and it is of considerable public importance, seeing the frequent damage which occurs to our beautiful churches and other edifices by strokes of lightning, to bring this question completely under the dominion of induction, observation, and experiment. The general principles which Sir W. S. Harris submitted as deducible from the inquiries to which he alluded are these:—If we imagine a ship or building to consist altogether of metallic substances, it would certainly be secure from any damage by lightning; and for this simple reason, that what we call lightning is the result of the electrical agency forcing a path through resisting matter such as the air, and extricating, with explosive and expansive force, both light and heat in its course. When, on the contrary, it falls upon comparatively non-resisting bodies, such as the metals, then this form of lightning vanishes, and the discharge assumes, if the metallic body be sufficiently capacious, the form of a comparatively quiescent current. Our object should be, therefore, in defending any building or ship from lightning, to bring the general mass so far as possible into that passive or comparatively non-resisting state it would have, supposing it a mass of metal. This is, in fact, the single and simple condition of such an application, without any reference whatever to assumed forces of attraction or peculiar specific powers manifested by certain bodies for the matter of lightning, and which really do not exist. This simple principle, by a careful mechanical arrangement calculated to render it practical and applicable to all the duties which the general structure of a ship together with its masts has to perform, is now universally carried out in the navy, with the most perfect success; so that damage by lightning in the vessels so fitted has, for the last fifteen years, quite ceased. The masts are made completely conducting by capacious plates of copper, reaching from the highest points to the keel; and are tied into one general connexion with all the great metallic masses employed in the construction of the hull, and united by the large bolts of copper passing through the keel and sides, with the copper expanded over the bottom and with the sea. It is quite impossible that a discharge of lightning can fall on the vessel in any place, and not be at once transmitted safely by the conductors, not under the form of lightning, but under the form of a current without explosion. Sir W. S. Harris then referred to some remarkable cases.

On Periodic Meteors, by the Rev. Prof. Powell.—The chief object of this communication was to place on record a table of all the remarkable appearances of luminous meteors which the author has been able to collect up to the present time, supplementary to the very complete list given in M. Quetelet's second Catalogue (Nouv. Mém. de l'Acad. de Bruxelles, tom. xv.) which comes down to the year 1840. This list is, doubtless, imperfect; but the author submits it to the British Association in the hope that its deficiencies will be filled up by the contributions of other members. He wishes to annex a few remarks on one or two points connected with the theory of these appearances. The question so much disputed as the connexion of *luminous meteors* with the fall of *meteoric stones*, appears to the author to be answered sufficiently by observing—1st. That some cases of such connexion are undoubtedly established. 2nd. That daylight is necessary to trace the actual fall of matter, when, consequently, a luminous meteor would be *invisible*, unless of unusual brilliancy; while the darkness which renders a meteor *visible* precludes the possibility of tracing the fall of stones. 3rd. Matter may fall in portions or a state of division too small to trace; and there is evidence, or strong probability, of matter having a meteoric origin in various lighter forms besides that of metallic or apparently fused masses. As to the *forms* of masses known to have fallen, they are by no means generally *angular* or *fragmentary*, as sometimes asserted; in many instances being *whole*, and rounded in form—sometimes, also, broken into fragments *by their fall*. There is no evidence of a mass *bursting* to pieces by an explosion; the detonation heard may be purely *electric*. Of the *size* of meteoric masses no sufficient evidence exists. The *apparent* diameters cannot be easily determined on account of the velocity of motion. And if they could, this would only give the size of the flame (if it be due to combustion) and not that of the solid mass, if there be one. If the height be too great to allow combustion, still less can the apparent size of the electric flash be any guide or proof of the existence of any solid body at all. Such small solid bodies *may* circulate in the solar system, but not probably in any great number or of large size, unless as truly planetary or satellitary bodies, but unformed diffuse masses of matter like that of comets or the zodiacal rings we know to be circulating in many parts of space; and it is by *condensation* out of this, that, as probably the existing planets, so, also, lesser asteroids and satellites may be continually forming, as likewise meteoric masses within the sphere of the Earth's influence, agreeably to Mr. Strickland's hypothesis. The observations of Brande, Benzenburg, and others, as is well known, have assigned great heights to many meteors, varying from 5 to 500 miles. But M. Quetelet has shown (2nd Mém. de l'Acad. de Bruxelles, tom. xv.) that the *mean* height is from 16 to 20 leagues, or *within* the limits of the atmosphere. Hence the majority of them *may* become luminous from *combustion.* Electric light can be displayed in vacuo. Hence we may have various gradations of the same phenomenon from purely electric flashes or explosions at great altitudes to more or less complete combustion at lower; by which the whole mass *may be consumed and dissipated,* or may be partially burnt, and the metallic ingredients more or less perfectly *reduced* or *fixed,* and in this condition portions or masses may fall to the earth. And the explosion is not the *bursting* of a mass, but an electric discharge: the particles or masses which fall are *portions,* not *fragments*; and the effect, instead of being one of *breaking up,* is one of *consolidation.*

Papers were also read by Dr. Forster, on Meteors, and by the Rev. T. Rankin, on Phosphoric Meteors. A lengthened discussion ensued on the reading of Dr. Forster's paper on Meteors, in which he endeavored to refute the cosmical hypothesis of the cause of meteors recently adopted by many astronomers. Dr. Forster stated that he was the first person who suggested the idea that these meteors were periodical as early as the year 1811; but that he had long ago given up the point, and attributed their apparent periodicity to changes in the electrical atmosphere. He concluded his paper by the production of a problem which explained and confirmed Aristotle's hypothesis of the cause of falling stars.

On a New Theory of the Polarization of Light, by Prof. Challis.—In this theory *ether* is regarded as a continuous fluid substance, and is treated mathematically on hydrodynamical principles. By means of a new general equation in hydrodynamics, which the author has discovered, he shows that a filament of the fluid may continue in agitation without lateral spreading, and that motion may be propagated along it uniformly, provided the motion consist of vibrations partly longitudinal and partly transversal, following the law of sines. Such a filament in motion is supposed to correspond to a ray of light. The sensation of light is due to the *transverse* vibrations. In a ray of common light the transverse motion is in planes passing through the axis of the ray, and is alike in all directions from the axis; in a plane-polarized ray the transverse motion is in planes not passing through the axis; and in an elliptically polarized ray the transverse vibrations are elliptical. Prof. Challis has extended his theory to the phenomena of double refraction, by a method which involves a new theory of the *dispersion* of light. He finds the surface of elasticity to be that of an ellipsoid; which is not in accordance with Fresnel's theory of double refraction. The equation of the wave-surface is, however, the same as in Fresnel's theory.

Among the other subjects which claimed the attention of Section A, we notice "A Report on Geological Theories of Elevation and Earthquakes," by W. Hopkins; "A Report on Atmospheric Waves," by W. R. Birt; "A Map of the Coast Survey of the United States," by A. D. Bache; "Observations on the general Nature and Laws of Electrical Attraction," by Sir W. S. Harris; "Suggestions for the Observation of the Annular Eclipse, Oct. 9, 1847;" "On the Cause of the Aurora, and the Declination of the Needle," by G. A. Rowell.

"On the Electric Currents by which the Phenomena of Terrestrial Magnetism may be produced," by Prof. Thomson.

From the Report of the transactions of Section B, on Chemical Science, we make the following selections:

Report on the Influence of Light on the Growth of Plants, by R. Hunt.—The author confirms the conclusions that seeds will not germinate under the influence of light separated from the chemical principle with which it is associated in the sunbeam; that germination being effected and the first leaves formed, light—the luminous rays—become essential to the plant to enable it to secrete the carbon obtained from the carbonic acid of the atmosphere; and that the increased action of the heat rays are essential to insure the production of the reproductive elements of vegetable life. It is found that the chemical principle of the solar rays is more active, relatively to heat and light, during the spring than at any other period of the year; that as summer advances this power diminishes and luminous force increases, whilst with the autumn both light and actinism are subdued, but the calorific radiations increased. Thus we find the conditions of the light of the seasons varying to suit the necessities of vegetable life. The production of chlorophyl, or the coloring matter of the leaves, was shown to be due to the joint action of light and actinism—the first being necessary to effect the secretion of the carbon, and the latter for the oxidation of this deposited carbon.

On Different Properties of the Various Rays of Solar Radiation on the Daguerreotype Plate prepared with Iodine, Chlorine, and Bromine, in Producing and Preventing the Fixation of Mercurial Vapor, by A. Claudet.—M. Claudet has made a series of observations upon light transmitted through certain coloring media, through the vapors of the atmosphere, and through red, orange, and yellow glasses. Having directed a camera obscura upon the sun when its disk appeared quite red, he obtained after 10 seconds a black image of the sun. The red sun had produced no photogenic effect, although the surrounding spaces had been sufficiently affected by the photogenic rays proceeding from the zenith to attract the white vapors of mercury. This proved that the red rays had no photogenic power. He then operated in a different manner; not content with the slow motion of the sun, he moved the camera obscura from right to left and *vice versâ.* In this manner the sun had passed rapidly over five or six zones of the plate. Its passage was marked by long black bands, whilst the intervening spaces were white; showing again that it was sufficient, in order to destroy the action of the photogenic rays, to let red rays pass rapidly over the spaces previously affected by them. He operated afterwards with colored glasses; after having obtained upon a Daguerrotype plate the impression of a black lace by white light, he covered one half of the plate and exposed the other half to the radiation of a red glass. The mercury developed an image of the lace on the part which had been acted on only by the white light; and the other part which had afterwards received the action of the red rays remained black. The red glass had destroyed the photogenic effect, as had taken place with the red light of the sun. He made the same experiments with orange and yellow glasses, and obtained the same results but in different periods of time. The photogenic action of the red rays is 5000 times longer than the white light, that of the orange is 500 times longer, and that of the yellow 100 times. The destructive action of the red rays is 100 times longer than that of white light; the orange 50 times, and the yellow only 10 times. When a plate has been exposed to the destructive action of any particular ray, it cannot be affected photogenically by the radiation which has destroyed the first effect; it is only sensitive to the other radiations.

Mr. R. Hunt remarked that his own observations had led him to the conclusion, that instead of having to deal with three differently-colored rays, we had to deal with three distinct principles,—these three colors only being a property of one of them. Light, heat, and actinism he regarded as antagonistic forces; and it was only because they were found in different proportions in the three classes of colored rays that the results of M. Claudet could be in any way associated with the colors of light.—Mr. Maskelyne objected to some of these conclusions.

Diamond Converted into Coke.—Dr. Faraday exhibited some diamonds, which he had received from M. Dumas, which had, by the action of intense heat, been converted into coke. In one case, the heat of the flame of oxide of carbon and oxygen had been used—in another the oxy-hydrogen flame—and in the third the galvanic arc of flame from a Bunsen battery of 100 pairs. In the last case, the diamond was perfectly converted into a piece of coke,—and in the others the fusion and carbonaceous formation were evident. Specimens, in which the character of graphite was taken by the diamond, were also shown. The electrical character of these diamonds was stated also to have been changed,—the diamond being an insulator, while coke is a conductor.

At the meeting of Section C, on Geology and Physical Geography, an interesting paper *On Ancient Sea Margins*, was presented by Mr. R. Chambers, together with several others, by different persons, on the local geological features of certain places in England, and other parts of Europe.

The proceedings of Section D, on Zoology and Botany, and of Section E, on Physiology, embraced a great variety of subjects, in the discussion of which, a number of learned and distinguished members participated.

The following extracts are from the report of the meeting of Section F, on statistics:

Mr. Porter read a paper *On the Influence of Education, as shown in the Criminal Returns of* 1845 *and* 1846.—He began by repeating his refutation of Mr. Guény's theory, published in an early number of the *Statistical Journal.* He then gave the following returns of criminals, having superior education, committed to prison in the years:—

Year.	No. of Criminals.	Of Superior Education.			
1836	20,984	191	less than	1	per cent.
1837	23,612	101	“	½	“
1838	23,094	79	“	⅓	“
1839	24,443	78	“	⅓	“
1840	27,187	101	“	·37	“
1841	27,760	126	“	·45	“
1842	31,309	69	“	·22	“
1843	29,591	140	“	·47	“
1844	26,542	111	“	·42	“
1845	25,403	89	“	·37	“
1846	25,107	85	“	·37	“
	25,812	106		0·41	

In a series of elaborate tables, exhibiting the returns which have just been given in almost every variety of which they are susceptible, Mr. Porter showed that female crime in the educated classes is so small that it can scarcely be received as an element in any statistical ratios. It would be impossible to render the entire argument of the paper intelligible in any reasonable space; and we are therefore compelled to limit ourselves to a summary of its results. The first is, that education appears to act as a preventive of crime by making manifest the consequences of actions. 2nd. That the crimes of the uneducated appear to be greatest in the best educated districts. 3rd. That educated females are far less liable to crime than educated males. And 4th. That among educated criminals there are fewer crimes of violence than crimes of fraud.

The discussion which ensued was just a repetition of the discussions at every meeting of the Association where the relations of education and crime have been brought forward. They related to “what constitutes education” and “what is the test of crime.” Col. Sykes and several other gentlemen contended that in educational reports what we have returned are *means* not *ends*. “Reading and writing,” it was said, “are no more education than knives and forks are a dinner.” And again, an increase in the return of the number of persons accused may signify, not an increase of crime, but an increased vigilance of police. To homologate the two sets of returns it is, therefore, obviously necessary that there should be a definition on the part of the educationists of that species of education which they deem a preservative against crime; and a careful examination of the circumstances of the localities from which criminal returns are obtained. On these two points the discussion was animated. It was finally resolved to adjourn the debate until Mr. Neison's paper should be brought under consideration on Monday.

On the Imports of Indian Cotton as compared with American Cotton, by Prof. F. Royle.—He began by describing the experiments made to improve the cultivation of cotton in India by American planters invited to India at the expense of the Hon. East India Company. These planters, seven in number, conducted their experiments over a wide extent of country, varied in soil and climate, in the three Presidencies. These experiments were undertaken in 1840; the most favorable country was Bundelcund, but two years of drought led to a failure. The next experiment was at the foot of the Himalayas, but hosts of insects destroyed the plants. In Coimbatore the experiment, however, was successful; better kinds of cotton were introduced, and cotton was perfectly cleaned by the American saw-gin. The cotton brought a good price in Liverpool. It appears that four thousand square miles are applicable to the growth of American cotton in the southern provinces of India. Since a new system of assessment has been introduced, at from eight to fourteen *anas* per acre, the cultivation of cotton by the natives has largely increased. Mr. Elphinstone has recently produced even better cotton than any of the American kinds, by hybridizing the native plant. The continued decrease of the price of American cotton is a fact of some importance; at the beginning of the century the price was 18d. per lb. and has fallen to 6d., a natural result of the increase of production. The demand for Indian cotton is generally dependent on the price of American cotton, and is subject to marked fluctuations. To this uncertainty Prof. Royle ascribed the weak state of the cotton commerce of India. Were demand steady, supply would be regular. Prof. Royle then produced a map of India, on which he pointed out the most favorable spots for the cultivation of cotton, stating the local circumstances of each—But these details could only be interesting to those minutely acquainted with the geography of India.

Major-Gen. Briggs detailed several experiments which had been made in 1816,—and attributed the failures to a bad choice of soil. He also stated that there was a large demand for uncleaned cotton in India, and that this cause disinclined the natives to clean their cotton.

Section G, on Mechanics, in consequence of a discussion with regard to uniting it with Section A, was not well provided with papers, and therefore held but two meetings. Among the subjects brought before it was a paper "On the Turbine," by Mr. Glyn, which was considered so valuable a communication that it was ordered to be printed entire in the "Transactions." Mr. Hodgkinson gave an account of some further "Experiments on the Strength of Iron Columns;" Mr. Ward described "an Apparatus for giving Light under Water in Diving Operations;" and some other communications were made which would have but little interest for our readers.

A number of distinguished foreigners attended at this meeting of the Association, among whom were M. Leverrier of France, Prof. Struve of Russia, Profs. Langberg and Esmark of Norway, and Prof. Nilsson of Sweden. At the conclusion of the meeting a vote of thanks was passed to the foreign gentlemen in attendance; for which acknowledgements were made by Prof. Struve in English, and by M. Leverrier, in French.

The next annual meeting is to be held at Swansea.

Application of the Rotary Fan-blower to Blast Furnaces.

By the following extract of a letter from one of the members of the Franklin Institute, now in England, it will be perceived that our attention has been called to a paper read before the "Institution of Mechanical Engineers" at Birmingham, in April last, "On the Use of the Fan-blast for Manufacturing purposes." This device, about which such a *blast* was made before that Institution, seems to be nothing more than the application of Stewart's Improvement of the Rotary Fan-blower, which was patented in the United States about seven years since, viz.: on the 17th of August, 1840. (See Journal of the Franklin Institute, Vol. II,—3rd Series, page 254.) This invention was submitted to the consideration of the Committee on Science and the Arts of the Institute, and a report made by the Sub-Committee to which it was referred, on the 10th of September, 1840.

Stewart's improvement consists simply in using two, or more, fan wheels on the same shaft, each contained in a separate chamber; the current generated by the first wheel is received into a second chamber, and passes through the second, third, and so on; if more than two are used. Compare this with Mr. Buckle's recent *discovery* that "by having a succession of fans, the first delivering the blast on to the second, and so on, the pressure from the third or fourth was 2½ lbs. per square inch."

But, to the letter:

"*London, June* 3, 1847.

"Dear Sir: The inclosed paper contains a notice of the successful application to an iron furnace in Derbyshire, of the ingenious *fan-blast*, patented many years ago in the United States, and of which a model was deposited at the Franklin Institute by the inventor. As usual it has been *re-invented* and patented here, some five or six years subsequently, and will now, doubtless, be much applauded for its ingenuity and importance. As this account, however, of its first practical employment on the large scale, might possibly not be inserted in any of the Journals received by the Institute, I send this newspaper report, from the Birmingham Gazette of May 24th, in order that the Committee on Publication might be able to give an early notice of an improvement which, I cannot but think, will be of great importance to our iron manufacturers. The cost of a complete set of blowing cylinders and machinery is a serious item in the expense of starting many of our small furnaces among the mountains, where capital is scarce:—these reduplicating fans would certainly cost but a small fraction of the other; would be less liable to get out of order, and would probably require much less power. * * *

"Vulcanized India Rubber was lectured on at the Royal Institution this winter, and Mr. Brockedon then detailed the circumstances which led to its *original* discovery by Mr. Hancock some three years ago,—while Goodyear's American Patent for the same compound is dated in February, 1839."

From the Birmingham Gazette: "The paper of Mr. Buckle 'on the use of the Fan-blast for manufacturing purposes," was then read; it stated that the author had tried a series of experiments, originating in the opinion that, by using a number of fans, a blast of sufficient intensity for the smelting of iron from the ore could be produced. After detailing the experiments, Mr. Buckle observed that the proper speed of revolution for the tips of the fan, whatever its size, was three-fourths of the theoretical velocity; that a greater velocity was an expenditure of power without an increase of blast; that the fan need not be made large; and that the area of the discharge and the density of the blast very nearly corresponded.—The Secretary also read a paper from Mr. Jones, of the Bridgewater Foundry, Bridgewater, corroborating the conclusions at which Mr. Buckle had arrived. In this paper it was stated that in that foundry they were manufacturing from fifty to sixty tons of iron per day by a consumption of only 200 lbs. of coke to a ton of iron, and that the engine in addition to that work, also kept from fifty to sixty smiths' fires in blast. The power required was about that of eight horses, and the pulley for driving had been proved to be superior to the strap. He had obtained those results from increasing the size of the air passages. The engine worked about seven hundred and fifty revolutions per minute.—The CHAIRMAN observed that the process as described by Mr. Jones showed extraordinary economy; and inquired whether Mr. Buckle had ascertained the relative values of long and short pipes to conduct the blast to the fire?—Mr. BUCKLE said he had not had an opportunity of trying. He found that, with the same number of holes open at each end of the pipe, the difference in the effect at the two extreme fires was so small that it could not be measured.—Mr. COWPER wished to ask whether the horse power mentioned by Mr. Jones was indicated, or commercial horse power. Was it the same as that indicated by Mr. Buckle?—Mr. BUCKLE replied that he had used a dynamometer with a spiral spring and piston, and having ascertained the power of the engine when disconnected with the fan, he had deducted that from the amount shown in every experiment. The engine was nominally fourteen-horse power. He had found that by having a succession of fans, the first delivering the blast on to the second, and so on, the pressure from the third or fourth was 2½ lbs. per square inch.—Alderman GEACH said he *knew that the plan was in use at a furnace in Derbyshire, where they obtained a pressure of 2¼ lbs. per square inch, making better iron and a larger quantity than by the old plan.*—Mr. BUCKLE said he was not aware that the plan had been tried; but he knew that there was a more uniform discharge from the succession of fans than from the blowing cylinder, and that the heat in the furnace was more equable.—Mr. HENDERSON remarked that, in Scotland, the firm with which he was connected had a fan which, although badly constructed, turned out 220 to 230 tons of castings, per week. They found that out of a Fairbairn's ordinary engine they could obtain about double the commercial power. He wished to know the proper form of the fan, and the proper length and size of the pipe; and whether, by laying down under-ground piping, they could effect their object as well as by having a shaft to conduct the power to the place where they wanted it. They had enlarged the tuyere pipe, having ascertained that in smelting iron the density of the air was less important than its quantity, and that it was required to be admitted in large quantities.—Alderman GEACH and Mr. H. SMITH quoted several instances, which (the CHAIRMAN remarked) went to show that the further the blast was from the fire the better. —The further discussion was adjourned.

Apparatus for Regulating Gas Lights.

We find in the "*Comptes Rendus*" of August 9th, a Report made to the French Academy of Sciences, by a Committee of that body, consisting of Messrs. Poncelet, Morin, and Payen, appointed to examine and report upon two Gas Regulators, submitted for inspection by Messrs. Mutrel and Pauwels. Conceiving this to be a subject worthy of some attention, we have prepared the following translation from the Report:

It is evident that if, in every place, the pressure of gas could be fixed, and maintained at a certain point during the time of burning, it would be easy to determine the size of the openings for feeding the flame, as well as the proper dimensions of the glass chimneys for the burners, in order to obtain the greatest amount of light for a given quantity of gas consumed. It is known that this maximum is only obtained when the *excess* of air necessary to produce complete combustion is as little as possible; for then the flame will be supplied with the greatest number of incandescent and luminous carbonaceous particles in the volume of gas burned.

But all these relations change with the variation of pressure, as may be generally perceived several times in an evening, by observing an ordinary gas burner. When the general lighting up is commenced in the evening, the first burners receive the gas under a maximum pressure, which must be moderated by diminishing the opening made by the stop cock; but as soon as the lighting up has become general, and a large number of burners are in operation, the flow of gas is greatly augmented, the pressure is diminished, and it becomes necessary to enlarge the opening by further turning the stop cock, in order to maintain the flame at the proper height. A contrary effect is produced when, late in the evening, the consumers of gas begin to extinguish their lights. The pressure is then increased in proportion as the flow is checked;—the flame rises too high in the burners;—and it thus becomes necessary, at least twice in each evening, to regulate the light by having recourse to the stop cock.

The inconveniences arising from these variations will be easily understood:—

1. The management of the light is more troublesome and difficult, and the expenditure of gas is increased.

2. Notwithstanding the utmost care, changes in the intensity of

the light, more or less sudden, will occur, occasioning fatigue and embarrassment to the sight.

3. Whenever an excess of pressure is indicated by an extension of the flame, the latter, for some moments, is no longer in the normal condition resulting from an excess of air; but, from a want of oxygen, the combustion is incomplete,—the carbonaceous particles, thrown into the flame in excess, pass unconsumed out of the glass chimney, and are dispersed in the air without being burned; and even part of the gas, with its sulphurous combinations, escapes combustion. Hence arise the disagreeable smell, the tarnishing of pictures, gilding, and furniture, as well as the unwholesomeness caused by all these substances in the air of a room. *

The inconveniences which we have enumerated are serious, particularly in large assembly rooms, theatres, and other public places, where the injury done to the drapery and decorations soon shows the effect of these influences.

The only known means of avoiding these injurious consequences of the variation of pressure, consists in tbe employment of a regulating apparatus. For a long time efforts have been made to this effect; but difficulties have been encountered in the mode of application, besides the obstacles, natural in some degree, which are to be expected when an attempt is made to introduce into buildings any new device which requires a particular place, and changes, in the smallest degree, the usual or habitual routine of the occupants.

The two regulators which have been successively presented to the notice of the Academy, appear to be sufficiently simple, accurate, and compact, to overcome the obstacles to one of the most desirable improvements in the use of gas. Both of them, like those which have preceded them, are based upon the use of a bell-shaped vessel, or little gasometer, the simple elevation of which, occasioned by the increase of pressure, causes the partial or total closing of the tube through which the gas flows; whilst, by the contrary effect of a diminished pressure, the vessel descends, and enlarges the opening for the passage of the gas. It is very easy to ascertain the proper degree of pressure, be it greater or less, which is requisite for the burners; and then simply to charge the vessel with such a weight that it will require this same pressure to keep it elevated.

The above mentioned effects are produced, in the regulator of M. Mutrel, by a lever, of which the shorter arm sustains the vessel, while the longer sustains a movable counterweight, the effect of which may be increased or diminished by changing its distance from the fulcrum. To this lever is affixed a vertical rod, which is attached to a lever moving the axis of a valve, so arranged as to be largely open when the little gasometer is at its lowest point; but which closes in proportion as the increasing pressure of gas causes that vessel to rise. In this way the pressure and flow of gas may be regulated.

Mutrel's regulator is used in several establishments at Rouen, Paris,

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* Note. The gas supplied from the Philadelphia Gas Works is so completely purified that no trace of sulphur can be detected. Com. Pub.

Batignolles, and in the signals of the Rouen railroad. In the latter, it regulates about 200 burners, and since the month of February, by its employment, not only have variations in the light been avoided; but a considerable saving in the consumption of gas has also been effected.

The regulator of Pauwels is more simple in its construction. Its useful effect is produced by a circular stopper, attached to the regulating vessel. When the pressure of gas causes this vessel to rise, the stopper moves forward in a conical tube, thus gradually checking the flow of gas, which it may even totally interrupt for an instant,—and in this manner furnishes a continued supply under a constant pressure. This regulator has been used in the theatre at Rouen for more than a year, and we have tried it with success in the Salle des Variétés at Paris.

It will be perceived that Pauwels' regulator differs from that of Mutrel, in the mode of checking the flow of gas through the tube; it has also the peculiarity that no branch, or exterior apparatus, is seen about the vessel;—and that its service cannot be deranged by an accidental shock, or by the interposition of a foreign body. It has also the advantage of allowing the regulator to be enveloped by a case of sheet iron, (cloche en tôle,) to which is affixed a discharging tube, the extremity of which, opening outside of the building, is covered with little disks of wire gauze; so that if, from any extraordinary diminution of water in the reservoir, or from any other cause, an escape of gas should occur, it would not spread throughout the building, but would be discharged into the open air.

In consideration of the interest attached to every means of producing conditions of economy, safety, and health, in the use of gas, we are induced to propose that the Academy return thanks to M. Pauwels and also to M. Mutrel, for the useful devices which they have communicated.

NOTE. An apparatus resembling that of Pauwels, has been used at the Philadelphia Gas Works since they first went into operation. It acts as a governor to regulate the pressure in the mains at large. COM. PUB.

Extract from an account of the Prattsville Tannery in "Hunt's Merchant's Magazine."

It would be a curious subject of speculation to inquire into the causes that have conspired to mark the American people with such an extraordinary degree of enterprise; but such an inquiry would lead us altogether too far from the immediate object of this article, which is to present a notice of one of the most striking instances of individual enterprise that our country affords. We refer to the great PRATTSVILLE TANNERY, in the county of Greene—the most extensive establishment of the kind in the world, founded and conducted by the enterprise and skill of a single individual, well known for his enlarged and liberal views—the Hon. ZADOCK PRATT, late member of Congress from New York. A succinct, historical, and statistical account of this establishment, conducted with a skill and energy which has realized a fortune to its possessor, and has been the means of spreading comfort and plenty all around him, cannot be uninteresting to the general reader, as well as to all those who are interested in a branch of manufacture which M'Culloch ranks as the fourth, if not the third, in the United Kingdom, and which probably holds a still higher rank in the United States.

For the materials of the following sketch of the Prattsville Tannery, and of the processes and extent of the manufactures carried on at that establishment, we are indebted to the kindness of the distinguished proprietor, who has now retired from the business, to enjoy the fruits of his honest, well-earned industry.

The Prattsville Tannery, as we have said, furnishes one of the most striking examples of individual energy and enterprise, which our country, fruitful as it is in such examples, affords. A little more than twenty years ago, the district of country in which it stands, was a perfect wilderness. Although just back of the well-known Catskill range, and not more than thirty-six miles from the banks of the Hudson, the great thoroughfare of our interior trade, the depths of its hemlock forests, the solitude of its mountain glens, and the flashing of its tumbling brooks, had been explored only by the foot of the hunter, and were as little known to the public as the slopes and valleys of the Rocky Mountains. In 1824, Col. Pratt visited this district, and, with unerring judgment, at once decided upon it as the proper location. With a man of Colonel Pratt's energy, from the conception of a project to its execution, is but a single step. With such men, to will and to do is one and the same thing. In less than ninety days, he had a tannery erected, and ready to commence operations.

This tannery is an immense wooden building, 530 feet in length, 43 feet in breadth, and two stories and a half high. Within this area are contained 300 vats, with conductors to draw the liquor to the pump, affording about 46,000 cubic feet of room for tanning purposes. A large wing, 40 feet by 80, extending over the stream, contains 12 leaches, six of which have copper heaters, each 28 feet long. The cubic contents of the leaches amount to about 12,000 feet, and also the bark loft, through which, in the course of the year, pass more than six thousand cords of bark. The mills through which it is ground, are capable of grinding over a cord of bark per hour, and it has connected with it a pump of sufficient capacity to deliver 1000 cubic feet of "ooze," or water charged with tannin, in 30 minutes. The beam-house contains thirty vats, equivalent to 7640 cubic feet. It has connected with it three hide-mills, for softening the dry Spanish hides, and two rolling machines, capable of rolling 500 sides of leather per day. Outside of the building, but connected with the beam-house by an under-ground communication, are eight stone sweat-pits, with pointed arches and flues. The pits are of the most approved size, being in area 10 feet by 14, and in depth 8 feet, with a spring of water at one corner.

Of the enormous amount of business done, and capital employed in this establishment, a good idea may be obtained from the following statistical data, which have been collected and tabularized with great care from Col. Pratt's systematic books:—

STATISTICS OF THE PRATTSVILLE TANNERY FOR TWENTY YEARS.

Various Materials Used, and Labor Employed.

6,666 acres bark land,=10 square miles,=18 cords to the acre,=120,000 cords of bark at $3			$360,000
No. of days' work peeling and piling do.	days		118,555
4 trees to the cord	trees		475,200
120,000 loads, or cords,=264,000,000 lbs.			132,000
444 acres of woodland, 32,000 loads, or cords, worth			32,000
135,380 bush. oats, at 2s. 6d.			41,967
1,200 tons of hay at $8			9,600
313,000 days' work in tannery,=1,000 years' labor, at $14 per month.		$162,000	
Board at $1 50 per week, or $6 per month		78,000	
			240,000
500,000 hides, cost (wet, salted, and dry)			1,750,000
5,700 loads of 2,600 lbs. each, (one pair horses,) or	lbs.	15,000,000	
1,000,000 sides of 18 lbs. per side		18,000,000	
			33,000,000
Cost of carting			$52,800
3,000 lbs. per load leather, one pair horses		6,000	
2,600 " hides		5,700	
			11,700
Freight of hides and leather between New York and Catskill			$30,000
Equal to 18,000,000 lbs. of leather, at 17 cts. per lb.			3,060,000
Lost and worn out about 100 horses, at $75 each			7,500
Cost of wagons, at $250 a year			5,000
Yearly expenses, $300,000—total expenses, about			6,000,000

A glance at this table will at once convince any one that the advantages of such an establishment are not confined to the amount of value produced. The labor employed, directly or indirectly, may be set down at two hundred men daily. The ramified branches of business and trade that it fosters, the comfort, refinement, and intelligence of which it becomes the centre, and its final influence upon the growth and populousness of the surrounding district, cannot be too highly estimated. The following table shows but one single item—the amount of labor employed within the walls, or that which is directly and immediately employed in the process of tanning; but, from a comparative inspection of it and the table above, some idea may be formed of the amount of labor indirectly engaged:

Average Number of Men employed at the Prattsville Tannery throughout the Year, with their respective Wages per Month:—

BEAM-HOUSE.

	No. of hands.	Pay.		
Foreman . . .	1	$32		$32
Choresmen . .	2	12	and $6 board.	36
Beamsmen . . .	12	14	"	180

IN THE YARD.

Foreman . . .	1	50		50
Handling and laying away	8	12	and $6 board	144
Brushing leather . .	4	12	"	72
Nightman to leaches .	1	14	"	20
Grinding bark by day .	1	12	"	18
" by night .	1	14	"	20
Wheeling bark . .	4	12	"	72
Filling and pitching leaches	3	14	"	60

DRYING LOFT.

Foreman . . .	1	20	"	26
Spunger . .	1	12	"	18
Rollers . . .	2	15	"	42
Hanging and taking down leather	2	12	"	36

MISCELLANEOUS.

Foreman out-doors .	1	41	"	47
Carpenter . . .	1	39	"	45
Teamsters . . .	12	11	"	218
Total . . .	58	.	.	$1,120

The following table presents a condensed view of the operations at the great tannery, during the last five years:—

	No. of hides rec'd at tannery.	Weight of hides.	Cartage.	Commissions.	Total value of hides.
1841 . .	30,984	724,168	$291·47	$5,701·47	$108,758·06
1842 . .	27,194	601,595	275·89	3,938·30	82,705·01
1843 . .	28,433	630,192	213·24	4,425·64	78,198·03
1844 . .	36,839	812,403	276·28	5,718·36	100,972·82
1845 . .	20,556	460,798	154·17	2,920·25	51,176·60
Total	144,006	3,229,155	$1,211·05	$22,704·02	$421,810·52

TABLE—CONTINUED.

	Leather returned to N.Y. *Sides.*	*Pounds*	Av. w'ght per side.	Av. nett price.	Com. on leather.	Nett proceeds of leather.
1841	61,729	1,211,856½	19·63	$14·44	$7,352·34	$175,018·54
1842	54,323	995,057¾	18·32	13·93	5,827·08	138,581·05
1843	56,742	1,061,523¾	18·71	13·60	6,053·42	144,331·83
1844	73,590	1,310,779¾	17·81	12·55	6,895·25	164,517·53
1845	40,891	737,571½	18·03	11·06	3,420·57	81,595·26
Total	287,275	5,316,789¼	18·51	$13·24	$29,548·66	$704,044·21

The tanning of leather, more than almost any other manufacture, is a chemical process, the success of which depends almost wholly upon the skill and judgment with which its complicated manipulations are conducted. To attain the requisite skill in the laboratory of the chemist, is evidently impossible; it can only be acquired in the tanning itself, by long and careful attention and observation; and perhaps there is no description of manufacture, where so much depends upon practical knowledge, and so little upon mere theory, as in the tanning of leather. The tanning of leather consists in effecting a combination between the gelatine, which is the main constituent of raw hides, and tannin: a peculiar substance, found in the bark of several species of trees—the oak and hemlock, chiefly. The processes employed are so various, and the modifications occasioned by temperature, strength of the liquor, and quality and condition of the hides, are so numerous and so different, that hardly any branch of business requires for its successful conduct a greater degree of judgment and experience, and in few arts have there been effected greater improvements. Col. Pratt informs us that since he first commenced business, the gain of weight in converting hides into leather has increased nearly fifty per cent. That is, that from a quarter to a third more leather can now be obtained from a given quantity of hides, than at the time when he learned his trade at his father's tannery, conducted in the old-fashioned way.

The great improvement in weight seems to have been gained by the judicious use of strong liquors, or "ooze" obtained from finely-ground bark, and by skilful tanning. In order to produce heavy weights, the hides should not be reduced too low in the beam-house, and should be tanned quickly with good strong liquors, particularly in the latter stage of the operation. To green hides, particularly, nothing can be more injurious than to suffer them to remain too long in weak "ooze." They become too much reduced, grow soft, flat and flabby, lose a portion of their gelatine, and refuse to "plump up." On the other hand, however, the effects of an early application of "ooze," that is too strong and too warm, to green hides, is very injurious. It contracts the surface fibres of the skin, tanning at once the external layers, so "dead," as it is termed, as to shut up the pores, and prevent the tannin from penetrating the interior. This renders the leather harsh and brittle. It will, from this, be seen, that in the question of the proper strength of liquor alone, there is room for the exercise of the greatest judgment and the most extensive experience. In the impossibility of adopting fixed rules to the innumerable variety of cases, nothing can be depended upon but the judgment of the practical tanner.

In softening hides, and preparing them for the process of tanning, a great deal also depends upon the judgment of the person superintending the operation, inasmuch as the diversities in the qualities and characteristics of hides render it impossible to subject them to anything more than a general mode of treatment. In "sweating," the character of the hides and the temperature are essential, but ever-varying, considerations. As a general rule, however, the milder the process of preparing the hides for the bark, the better. Unnecessarily severe or prolonged treatment is inevitably attended with a loss of gelatine, and a consequent loss of weight and strength in the leather. Too high a temperature is particularly to be avoided.

In almost every lot of hides, particularly the Oronocos, however, there are generally some that prove very intractable—resisting all the ordinary modes of softening. For such, a solution of ashes, potash, or even common salt, will be found to be beneficial.

As we have said, no precise rule can be given as to the length of time required for the preliminary process of soaking and "sweating"—so much depending upon the qualities of the hides, and the temperature at which these operations are conducted.

The following table, however, may be found useful in conveying an approximation to a definite idea of the practice in the Prattsville Tannery:—

	SOAKING.				SWEATING.			
Temperatures.	40°	50°	60°	70°	40°	50°	60°	70°
	Days.	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*
Buenos Ayres hides	10 to 12	8 to 12	6 to 8	3 to 6	15 to 20	12 to 16	8 to 12	2 to 3
Carthagena and Laguira	8 12	7 9	5 7	2 5	15 20	10 15	6 8	2 3

Salted hides do not require more than about two-thirds the time to soak, but about the same time to sweat.*

After the hides are prepared for tanning, the next process is, what is commonly called "handling," which should be performed two or three times a day in a weak ooze, until the grain is colored, new liquor being preferable to old. They are then, after a fortnight, laid away in bark, and changed once in two to four weeks until tanned. Much care and judgment is requisite in proportioning the continually increasing strength of the liquors to the requirements of the leather in the different stages of this process. The liquors should also be kept as cool as possible, within certain limits; but ought never to exceed a temperature of eighty degrees. In fact, a much lower temperature is the maximum point, if the liquor is very strong—too high a heat, with a liquor too strongly charged with the tanning principle, being invariably injurious to the life and color of the leather. From this, it would seem that time is an essential element in the process of tanning, and that we cannot make up for the want of it by increasing the strength of the liquor, or raising the temperature at which the process is conducted, any more than we can fatten an ox or a horse, by giving him more than he can eat. It may be questioned whether any patented schemes for the more rapid conversion of hides into leather, will be found, on the whole, to have any practical utility.

We have mentioned the injurious effects resulting from too strong a solution of the active principle of the bark; on the other hand, the use of too weak solutions is to be avoided. Hides that are treated with liquor below the proper strength, become much relaxed in their texture, and lose a portion of their gelatine. The leather necessarily loses in weight and compactness, and is much more porous and pervious to water. The warmer these weak solutions are applied, the greater is this loss of gelatine. To ascertain whether a portion of weak liquor contains any gelatine in solution, it is only necessary to strain a little of it into a glass, and then add a small quantity of a stronger liquor. The excess of tannin in the strong solution, seizing upon the dissolved gelatine in the weak liquor, will combine with it, and be precipitated in flakes of a dark curdled appearance, to the bottom. At the Prattsville Tannery, the greatest strength of liquor, used for handling, as indicated by Pike's barometer, is 16°. Of that employed in laying away, the greatest strength varies from 30° to 45°.

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* In sweating, the temperature rises as the hides sweat, so that the operation is seldom performed under 50°. It is particularly recommended that, for the tougher hides, the heat should never be greater than 60° or 65°.

After the leather has been thoroughly tanned and rinsed, it will tend very much to improve its color and pliability to stack it up in piles, and allow it to sweat until it becomes a little slippery from a kind of mucus that collects upon the surface. A little oil added at this stage of the process, or just before rolling, is found to be very useful.

Great caution is necessary in the admission of air in drying, when first hung up to dry. No more air than is sufficient to keep the sides from moulding should be allowed. Too much air, or, in other words, if dried too rapidly in a current of air, will injure the color, giving a darker hue, and rendering the leather harsh and brittle. To insure that the thick parts, or butts, shall roll smooth and even with the rest of the piece, it is necessary that the leather should be partially dried before wetting down for rolling, and that, when wet down, it should lay long enough for every side to become equally damp throughout.

The following table, condensed from the tanning records of 200,000 sides, exhibits the time required to tan the various descriptions of hides at Col. Pratt's establishment, during a period of four years. It will be seen that the same description of hides require different times in different years. This is owing mainly to a difference in the temperature and weather of the several seasons, and the quantity of sides and strength of liquor in the vats, and partly to the different conditions and qualities of different lots of the same descriptions of hides:—

	No. of sides.	Time of tanning.	
		mo.	*ds.*
1841—San Juan	7,500	4	20
Oronoco	3,500	5	15
"	1,900	6	..
"	9,000	6	10
Laguira	22,000	7	15
Oronoco	6,500	5	15
Matamoros	1,100	5	..
"	2,300	5	20
San Juan	6,500	4	15
Montevideo	5,800	4	..
1842—Honduras	3,600	6	20
Buenos Ayres	10,500	6	10
Chagres	1,700	6	..
1843—Oronoco	1,100	5	..
Montevideo	2,700	5	..
1843—Rio Grande	5,800	4	20
1844—Buenos Ayres	6,500	6	20
Oronoco	5,400	7	..
California	1,200	6	20
Buenos Ayres	900	7	10
"	6,500	5	10
Oronoco	1,500	4	20
Rio Grande	2,100	5	..
"	4,000	5	10
Oronoco	2,800	6	10
Laguira	5,100	7	..
Rio Grande	1,100	7	..
Buffalo	2,000	5	..
Buenos Ayres	2,000	6	..
Rio Grande	8,500	6	10

From this, it will be seen that the average time of tanning in 1842, was five months and seventeen days; of 1843, five months and twenty-two days; of 1844, six months, and of 1846, six months and eleven days. Average of the whole time, five months and twenty-seven days. The average weight of the leather was seventeen pounds per side. This, according to the best authorities we have at hand, is considerably below the time employed in England. There, it is no uncommon thing for eight and ten months to be employed in tanning a stock of leather, and some of the heaviest leather, it is said, takes even fourteen and fifteen months. Such deliberation undoubtedly insures a fine quality of leather, but it may be questioned whether there is not a great loss in the increase of weight—a loss of interest on capital, and in consequence an unnecessary enhancement of price.

It would be wrong in us to conclude a notice of this useful mechanical establishment, without a word or two respecting the flourishing village which it has been the means of creating. Twenty years ago, there stood a dense wilderness of hemlock, and now a beautiful village of nearly two thousand inhabitants occupies its place. The village was laid out in lots, by Colonel Pratt, on which he has erected "his hundred houses." The main street is nearly a mile in length, upon either side of which is a row of beautiful maple and elm trees, and a neat gravel walk, running the whole length of the street. These improvements were the work of the founder of the village entirely. The houses and the buildings are placed on a line at the distance of twenty feet from the street, and generally painted white. The village now contains three churches, an academy, four schools, two woollen factories, making 500 yards of cloth per day, one cotton manufactory, three machine-shops, three grist-mills, three saw-mills, two mitten and glove factories, one India-rubber factory, a printing-press, besides watch-makers, cabinet-makers, coopers, and other mechanics. There are also seven stores, three hotels, and a post-office, the amount of the business of which may be judged of, from the fact that its receipts have increased from $5 to $500 per annum. It is in contemplation to make Prattsville the centre of a new county. And from this hemlock tannery the persevering founder of this village has grown a bank, with a capital of $100,000. Col. Pratt's establishment has thus furnished a nucleus around which has clustered the habitations of civilization and refinement, and has thus proved the agent of fulfilling in its immediate sphere the prophetic words, "the wilderness shall blossom as the rose."

Of this enterprising Tanner, Farmer, Legislator, and Banker, it may be truly said, that he has been the architect of his own fortune. He has conducted his vast business without a single case of litigation, never impeding the course of others, but always lending a liberal hand; and has learned the value of his own maxims of "letting well enough alone," and of "doing well enough," by "minding his own business."

On Lord Rosse's Telescope.

Dr. Robinson, when giving, in November, 1840, to the Academy, an account of the three-feet telescope constructed by the Earl of Rosse, had announced to them the intention of that nobleman to attempt an instrument of double aperture and focal length. The attempt had succeeded even beyond expectation, and he hoped that a brief notice of its progress and results would not be uninteresting; more especially as he felt that the approbation with which they had received his former communication, and the importance which they attached to Lord Rosse's discoveries, had not been the least powerful cause of the triumph which their countryman has now achieved.

The speculum was cast on the 13th of April, 1842, according to the principles which had been so successfully applied to the smaller mirrors; but with several changes of the details, made necessary by the gigantic scale of the work.

It is well known to all who have experimented on specula, that the alloy must be formed in the first instance, and re-melted for casting at a much lower heat: otherwise the mirror is full of pores. The fusion must, in both cases, be effected in covered crucibles, to preserve the definite proportions of the alloy, which would be *lowered* by oxidation of its tin if exposed to the draught of the furnace. It is also necessary that the speculum be of uniform composition and superficial density; and, as it is impossible to fuse the requisite quantity of metal for one of six feet in a single vessel, the different portions must flow into the mould under circumstances as nearly as possible identical. Much thought and many experiments must have been expended before these conditions were so completely fulfilled. The crucibles are, of course, cast iron; no earthen one being able to bear the pressure of such a mass of fluid metal at so high a temperature. They are thirty inches internal depth, and twenty-four diameter, weighing about half a ton each, and manufactured with the precautions pointed out by Lord Rosse (Phil. Trans. 1840). Notwithstanding their great strength, they yield so much that it is obviously hazardous either to use them frequently or to increase their dimensions. They were employed at once, each containing about one and a half tons of the alloy; they were placed in furnaces whose mouths were level with the ground, eight feet deep and four in diameter, disposed round a large stack or chimney, into which their flues vent. The fuel is turf, peculiarly fitted for this work, as giving a much more manageable heat than coke; about 2200 cubic feet of it are consumed in a casting. The furnaces were filled with fuel, and ignited at the top, on the preceding evening, that the crucibles might be gradually heated; and in about ten hours they were ready to receive the metal. This was unintentionally made of a lower standard than that of the three feet, in consequence of the atomic number for tin being taken as given in Turner's Chemistry, 57·9 instead of 58·9, causing a deficiency of about half per cent., too trifling to impair materially its reflective power, though it will certainly make it more liable to tarnish. That its uniformity might be insured, each ingot of it was broken into three pieces, as nearly equal as possible, and stored in three casks, each of which contributed equally to form the successive charges of the crucibles in an order regularly varying. They were charged at intervals of two hours, and the whole was fused in twelve: they were then withdrawn from the furnaces by a powerful crane, and transported to the iron cradles of pouring frames, arranged 90° asunder round the mould.

The essential part of the mould is its base, composed of hoop iron six inches broad, packed on edge in a strong frame seven feet diameter, and supported by strong transverse bars below. The upper surface was turned to a convex segment of a sphere, 108 feet radius, on the polishing machine, over which a self-acting slide rest was fixed, whose frame was of the same curvature. This process required several weeks, and it was then ground smooth by a frame filled with concave blocks of sandstone. The bed of hoops so prepared being set exactly level, and heated sufficiently to blue its surface (for the purpose of burning out the tallow with which its interstices are filled, when not in use, to protect it from oxidation), the wooden pattern of the speculum was placed on it, and founders' sand rammed round it to its top. The mould thus formed was about a foot deep; the thickness of the speculum, 5½ inches in this instance, being determined by the quantity of metal melted. By this arrangement, as Dr. Robinson formerly explained to the Academy, the fluid metal which comes in contact with the hoops is *chilled* at once into a dense sheet about half an inch thick; the air which might be entangled with it in pouring, escaping through their interstices. The circumference sets much more slowly in consequence of the inferior conducting power of the sand; and the upper surface, which is only in contact with air, remains so long fluid, that the greatest part of the shrinkage occurs there; its tendency to crack the cast is prevented, and the coarse structure which it produces is confined to a place where it is unimportant.

On this occasion, besides the engrossing importance of the operation, its singular and sublime beauty can never be forgotten by those who were so fortunate as to be present. Above, the sky, crowded with stars and illuminated by a most brilliant moon, seemed to look down auspiciously on their work. Below, the furnaces poured out huge columns of nearly monochromatic yellow flame, and the ignited crucibles, during their passage through the air, were fountains of red light, producing on the towers of the castle and the foliage of the trees, such accidents of color and shade as might almost transport fancy to the planets of a contrasted double star. Nor was the perfect order and arrangement of every thing less striking; each possible contingency had been foreseen, each detail carefully rehearsed; and the workmen executed their orders with a silent and unerring obedience worthy of the calm and provident self-possession in which they were given.

It has been found that a good criterion of the time for pouring the alloy into the mould is afforded by stirring it with a pole of dry wood. This, as long as the temperature is above a certain point, reduces the film of oxide which covers its surface; and it becomes clean and bright, though a new film forms immediately. At length as it cools this reduction no longer occurs; and at a signal the three crucibles are emptied into the mould by means of levers connected with the pivots of their cradles. Though familiar with heavy castings, Dr. Robinson had never seen anything so magnificent as the burning lake that was then produced; and for many minutes it rolled in heavy waves like those of quicksilver, which broke in a surf of fire on the sides of the mould, effecting the most perfect mixture of the metal. At last it became solid, and was examined as it cooled, till it barely yielded to pressure with an iron rod at its centre, which is the indication that it may be removed to the annealing furnace.

This furnace extends along the fourth side of the mould: it is a low square chamber lined with firebrick, with sides about thirty inches thick, strongly hooped, and covered by an arch, from the centre of which rises a flue. Its floor is convex, of the same curvature as the speculum, and is heated from beneath by nine arches, which communicate with lateral flues. It opens towards the mould by a low arch a little wider than the speculum; but behind has merely an aperture to admit an iron bar. For some weeks the chamber and arches had been kept full of burning turf, so that the whole interior was of a full red heat. The speculum, also red hot (at which temperature, it is to be remarked, the alloy has nothing of that brittleness which characterizes it when cold, but is as tough as malleable iron), was cleared from the sand, and encircled by a strong ring attached to the bar above mentioned. By connecting this bar with a powerful capstan, it was drawn from the bed of hoops, along strong beams covered with iron, to its place in the centre of the annealing furnace. The ring was then removed, and the rest of the chamber filled up with charcoal; the arches with fuel; all the flues and apertures were closed carefully with masonry, and it was left to cool gradually for sixteen weeks, during the first three of which the exterior of the building was sensibly warm.

In the course of this year considerable progress was made with various parts of the mounting; and when Dr. Robinson visited it in February, 1843, he found that the speculum had been ground on a machine similar to the old one, but of strength proportioned to its work; that the foundations of the piers were laid, the tube was in preparation, and the massive frame-work and levers by which the speculum is supported in the tube were cast. This elegant contrivance requires some explanation. Suppose the back of the mirror divided by two concentric circles into three portions, of which the central circle is cut by radial lines into six sectors, the middle zone into nine segments, and the exterior into twelve, and that all of these are equal. If each of these be supported by an equal force applied at its centre of gravity, the speculum is obviously in the most favorable condition as to flexure. The frame mentioned above is rectangular, with a cross-piece cast in one, and weighs one ton and a half; it bears three strong triangles, also of cast iron, supported at their centres of gravity on hemispherical bearings. Each angle of each of these bears a similar triangle, the angles of which give the twenty-seven points of equilibrated bearing for the speculum. They do not, however, press directly, but carry platforms of cast iron of the shape of the areas which they are to bear, and made exceedingly stiff by flanches at their edges, and by edge-bars crossing them diagonally. A layer of felt is over these; strong uprights from the frame of a similar character prevent any lateral shifting; and the operation of the arrangement is found to be perfect at all altitudes.

The construction of the tubes, the piers, the mechanism of the counterpoises, occupied the remainder of this year and the beginning of 1844. In August, a partial polish was given to the mirror in order to verify its focal length (which was found exactly fifty-four feet); and the observing galleries and the apparatus for controlling the instrument in right ascension were proceeded with. All these gigantic constructions (of whose prodigious mass some idea may be formed from the fact that they contain, along with their other materials, more than one hundred and fifty tons of iron castings), have been executed in Lord Rosse's workshops, by persons taken from the surrounding peasantry, who, under his teaching and training, have become accomplished workmen, combining with high skill and intelligence the yet more important requisites of steady habits and good conduct. It may also be mentioned that (such was the clear and definite arrangement of the whole in its inventor's mind) nothing failed from first to last; and it was not necessary for him in any instance to retrace his steps.

At the beginning of February, 1845, the work being sufficiently advanced to permit the use of the instrument without personal danger, Dr. R. and his friend Sir James South were invited to enjoy the trial of it. Its appearance is certainly peculiar, and presents a striking contrast to the more complicated framing of the three-feet telescope which is placed beside it. At first sight, one wonders how it is to be moved, for nothing attracts notice except the massive piers and the tube; but a nearer approach shows that it is the perfection of mechanical engineering. To have mounted it on the plan of the three-feet would have been impracticable as well as useless. The speculum with its supports is seven times the weight of that in Herschel's four-feet, and both on this account, and the well-known principle that similar machines are weaker in proportion to their bulk, such a stand must have been so heavy as to present great obstacles to its motion. The vast surface exposed to the action of wind must have made it unsteady; and its durability could not be great. Lord Rosse, therefore, determined to confine the range of observation to the vicinity of the meridian. There the stars are at their greatest altitudes, and atmospheric influences effect them least; their places can be determined with most accuracy, and an equatorial movement, so essential to micrometer measures, can be easily obtained. With such optical power there will never be a scarcity of objects for examination; and the restriction will only be felt in the case of planetary bodies. The base of the actual mounting is a very massive joint of cast iron; its lower axis permitting motion in the meridian plane, its upper in a direction perpendicular to that circle. On this is firmly bolted a cubical wooden chamber, about eight feet wide, in which the speculum is placed, one of its sides opening for the purpose. This again carries the tube, which, when vertical and viewed from the interior of the chamber, is more like one of the old round towers than any more ordinary object of comparison. It is fifty feet long, eight feet in diameter in the middle, but tapering to seven at the extremities: it is made of deal staves an inch thick, hooped with strong iron clamp-rings, and secured from collapse by iron diaphragms; and carrying at its upper extremity the apparatus of the Newtonian small mirror, which, from its great weight and bulk, requires to be counterpoised. The telescope is moved in declination by a strong chain cable attached to its top and passing over a pulley fixed at a proper height to the north, down to a windlass on the ground which is wrought by two workmen. East and west, near the top of the piers, large iron pulleys are fixed, having free movement in azimuth, so that their planes may always be in those of the traction: chains suspending the counterpoise weights pass over these to the sides of the tube. The weights, however, are constrained to descend in quadrants of circles by chain guys attached to the frame which bears the declination pulley. It is easily seen that their action is a maximum when the tube is level, and nothing when it is vertical: but between these positions it decreases more slowly than the downward tendency of the tube. To correct this, the tube is connected with loaded levers (placed to its south), by chains of such lengths that one of them is not raised till it is at 40° altitude, and the other at 80°; the latter being necessary for the return of it after it has passed the zenith. The slow motion in declination was not yet applied, but the ordinary one was quite convenient, except for the difficulty of giving orders to the men, who were sometimes seventy or eighty yards from the observer. A two-feet circle, with a fine level and a pair of verniers, will also be attached to the tube to give the declination; its place was then supplied by a small protractor, five inches diameter, over which was a strong screen to protect the assistant who attended it from any such casualty as the fall of an eye-piece.

The eastern pier bears what may be called the meridian of the instrument: it is a strong semicircle of cast iron, about eighty-five feet diameter, and composed of several pieces accurately planed. Each of these is bolted to the pier and separately adjustable to a meridian line formed by straining a fine wire over notches in two cast iron chairs firmly secured at the north and south of the masonry. Sir James South took charge of this delicate operation, and performed it with such precision that when a transit instrument was adjusted by this line, it gave the passage of Polaris *to a small fraction of a second.* The telescope is compelled to move in the meridian, being connected with this circle by a strong bar provided with friction rollers, that it may traverse it easily; and thus it can be used as a transit instrument with considerable precision. But this bar is racked, and attached to the tube by wheelwork, so that a handle near the eye-piece enables the observer to move it on either side of the meridian, and thus examine it before its passage, or follow its motion. The movement is surprisingly easy; and a rough graduation on the bar supplies at present the place of an hour circle for finding objects, for which it is quite sufficient, except that the strong light required to set it disturbs the repose of the eye. The elder Herschel has not in the least exaggerated the importance of this, when faint objects, especially nebulæ, are to be examined; and a better contrivance is to be applied: The rack being perpendicular to the meridian, gives a motion not strictly equatorial, but easily made so : had the declination pulley been in a parallel to the earth's axis, passing through the great joint, and had this latter been itself equatorial, this would have been the case; but the deviation is easily corrected by the addition of a second pulley altering the direction of the chain. Its range is half an hour on each side of the meridian for a star at the equator; and Lord Rosse intends to effect it by clock-work, as is now generally the case in large equatorials; though the problem is much more difficult than in those instruments.

The western pier supports the stairs and galleries destined to the observers. Up to 42° of altitude is commanded by the first of them: a strong and light prismatic framing slides between two ladders attached to the southern faces of the piers: it is counterpoised and is raised to any required position by a windlass; its upper plane affords support for a railway on which the observing gallery moves about twenty-four feet east and west, two of its wheels being turned by a winch near the observer. Three other galleries in succession reach to 5° below the pole; these are each carried by two beams which run between pairs of grooved wheels, and are drawn forward, when they are turned, by a mechanism of singular elegance. These are able to hold twelve people, but one man can easily work them; and though it is rather startling to a person who finds himself suspended over a chasm sixty feet deep, without more than a speculative acquaintance with the properties of trussed beams, all is perfectly safe. Every bearing part has been *proved* to ten times its utmost probable load, and the doors of the galleries open inward, and are kept close by springs. From this point too is obtained the most distinct perception of the telescope's prodigious bulk, which at a greater distance is not so striking, for want of a standard of comparison; yet, notwithstanding the hugeness of the masses to be moved, so effective are all the arrangements that Sir James South found it was possible to uncover the mirrors and find a given star in less than eight minutes.

(To be continued.)

New Process for Heating the Blast of Furnaces without Coal or Labor.

In our last Journal,* we briefly alluded to the important invention of Messrs. Dixon and Budd, of the Ystalyfera Iron-Works, by which a great improvement has been effected in the manufacture of iron. The process is so well explained by the patentees, that we prefer adopting their own description and drawings, that our readers may understand the nature and advantages of the system, as practised by themselves:—

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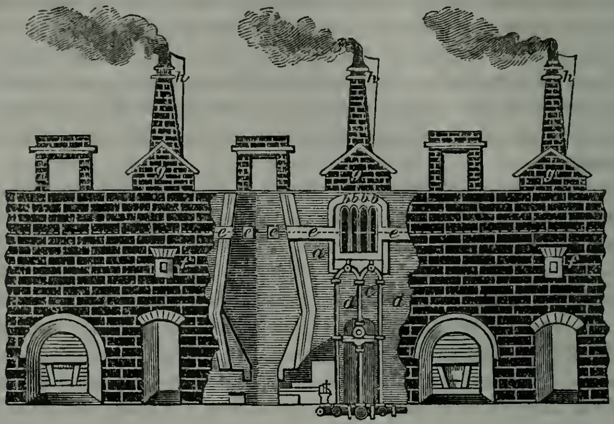
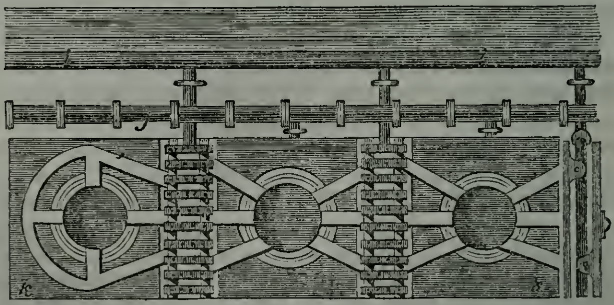
* Mining Journal, No. 618.

HOT BLAST.

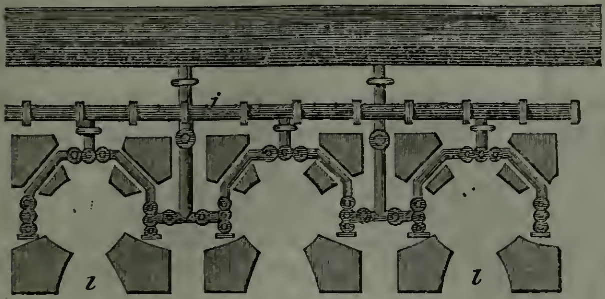
Plan and Elevation of Blast Furnaces, with Sections; showing the method of Heating the Blast, according to Dixon and Budd's Patents, as practised for working Six Furnaces at the Ystalyfera Iron-Works.



a. Cross section, through heating-stove and furnace, showing—
b b. Hot air tubes.
c. Inlet pipe, for cold air.
d d. Outlet pipes, for hot air to tuyeres.
e e. Flues, for heating the stoves from furnaces.
f f. Iron doors, for admitting air and cooling stoves.
g g. Top and roof of stoves.
h h. Stacks, with dampers to regulate heat in stoves.



ii. Cold blast main.
j j. Hot blast main.
k k. Horizontal section of furnaces, heating flues, and stoves.



l l. Ground plan of furnaces, and hot blast pipe communication with tuyeres.

The patentees, in introducing to the notice of the iron trade their improvements in the manufacture of iron, do so with the confidence arising from continued and successful practice. They preferred the delay of waiting until they were in this strong position, rather than call the attention of the trade to their plans, whilst they were in the state to which all practical men have a well-grounded aversion—viz., that of an experiment.

The patentees can now confidently assure the trade, that their patented improvements for heating the blast of iron furnaces, as set forth in the accompanying plan, possess the following advantages:—

1. The first cost of erecting the apparatus is considerably less than that usually employed.
2. The liability to get out of repair is much less.
3. The temperature of the blast can be preserved higher, and more equal.
4. There is no cost of coal or labor—neither being required.
5. The working of the furnace is not at all interfered with.
6. The stoves can be readily cooled down without derangement of the apparatus, when cleaning or repair is required.

The patentees, being ironmasters themselves, know that no saving in first cost, coal, or labor, would be considered by the trade as a compensation for frequent repairs. They also know that in many instances the whole benefit of the hot-blast process, and in some instances more than such benefit, has been swept away by the cost and irregularity attendant on the repairs of the apparatus. But they can assure the trade, that their apparatus is not liable to get out of order. At the Ystalyfera Iron-Works the hot-blast pipes that were put to work in October, 1844, are still at work and in good repair. They believe that there is nothing in the whole experience of the trade equal to this duration; but more than this, they are sanguine that where their improvements are carried out under their instructions, the stoves will last longer than the furnaces. At the Ystalyfera Iron-Works, near Swansea, six furnaces may be seen in operation, the blast being perfectly heated to the point of melting lead, by the plan of the patentees applied to five heating stoves. The dampers on the stacks afford the means of moderating the temperature, whilst the doors in front give a perfect command of the stoves, as the draught can be reversed, and a current of cold air introduced at a moment's notice.

Although the plan adopted at the Ystalyfera Works, as shown in the drawing, of having the furnaces in one connected range of buildings, with hot and cold blast main pipes, is the one recommended where new furnaces are being erected, yet this is not essential. The plan was first tried on a single furnace, and the stove was heated on one side only, yet the application was perfectly successful. It may, therefore, be readily applied to single furnaces standing apart, as is usual in iron-works.

As the benefits arising from the adoption of the plans of the patentees amount to many shillings a ton of iron made (a most important consideration in these times of competition, especially where large quantities are made weekly), besides great comfort and regularity, the patentees respectfully invite the attention of the trade to the subject. In order to ensure an early and extensive use, they have resolved on making a very moderate charge only for their patent right. As the hot-blast apparatus at present in use, requires such frequent renewal and repairs, opportunities will occur in every iron-works, within a short period, of introducing the plans of the patentees without any, or with only a small additional, charge as dead outlay.

The patentees, therefore, congratulate themselves on being enabled to present to their brother ironmasters a plan by which all the benefits of the hot-blast process may be secured, free from the hitherto great drawbacks of current expenses and repairs. They have not attained this end without great cost and perseverance; and they look for a liberal support from the trade, now that they present their improvements in the manufacture of iron, freed from all the doubt and risk of an experiment. Min. Jour.

On the Manufacture of Shell Cameos. By MR. GRAY.

The author commenced by stating that the ancients formed cameos by engraving figures in low relief on different kinds of siliceous stones; and generally selected for that purpose those which had layers of different colors: so that the figures, or different parts of the same figures, were of divers colors. Such cameos are now made in Southern Europe and in France—where this art has lately been attempted to be revived; but the hardness of the materials requires so much labor that they are too expensive to come into general use. Numerous attempts have been made to substitute various materials, such as porcelain and glass, for the ancient cameos; but their great inferiority has caused them to be neglected. The best, and now most used, substitutes are shells; several kinds of which afford the necessary difference of color, and are at the same time soft enough to be worked with ease, and hard enough to resist wear. The shells used are those of the Flesh-eating Univalve—which are peculiar as being formed of three layers of calcareous matter, each layer being a perpendicular lamina placed side by side. The cameo cutter selects those shells which have the three layers composed of different colors, as they afford him the means of relieving his work; but the kinds now employed, and which experience has taught him are best for his purpose, are the Bull's Mouth, the Black Helmet, the Horned Helmet, and the Queen Conch. The two first are the best shells. After detailing the peculiarities of these shells, the writer proceeded to give an account of the progress of the art, which was confined to Rome for upwards of forty years, and to Italy until the last twenty years, at which period an Italian commenced the making of them in Paris; and now about 300 persons are employed in this branch of trade in that city. The number of shells used annually, thirty years ago, was about 300; the whole of which were sent from England—the value of each shell in Rome being 30*s.* To show the increase of this trade, the number of shells used in France last year was nearly as follows:—

Bull's Mouth	80,000,	average	price	1*s.* 8*d.*,	value	6,400*l.*
Black Helmet	8,000,	"	"	5*s.* 0*d.*,	"	1,800*l.*
Horned Helmet	500,	"	"	2*s.* 6*d.*,	"	60*l.*
Queen Conch	12,000,	"	"	1*s.* 2½*d.*,	"	700*l.*
	100,500 shells,				Sterling	£8,960

The average value of the large cameos made in Paris is about 6 fr. each: giving a sterling value of 32,000*l.*; and the value of the small cameos is about 8,000*l.*—giving a total value of the cameos produced in Paris for the last year, of 40,000*l.*; while in England not more than six persons are employed in this trade.—*Proc. Soc. Arts.*

Athenæum.

Proceedings of the Annual Convention of Inventors, held in the city of Boston, Massachusetts, in September, 1847.

Communicated for the Journal of the Franklin Institute.

The third annual convention of Inventors and others interested in inventions and patents, convened in the city of Boston, on the 22nd Sep. inst., in pursuance of a call of the executive committee, authorized by the last convention of Inventors of the United States, held in the city of Philadelphia, October 27, 1846.

The convention was called to order by Col. E. Clarke, of N. Y., George Daracott, Esq., of Boston, was chosen President, and J. J. Greenough, Esq., of Washington, D. C., Secretary. On motion of Mr. Keller, of N. Y., the convention then adjourned to 9 o'clock the next day.

23d. The convention met pursuant to adjournment, and further organized by electing Hon. Judge Phillips, of Boston, and Col. E. Clarke, of N. Y., Vice Presidents, and Geo. Gifford, Esq., of N. Y., an additional Secretary.

The chairman of the executive committee, appointed at the last convention, reported the proceedings of the committee during the interim, and also read the bill proposed to be passed by Congress, together with sundry amendments proposed by the committee, giving their reasons for the changes suggested. He also explained the course of proceedings in Congress in relation to the bill, during the last session, and the causes of its failure at that time—and further urged the necessity of increasing the salaries of the Examiners of Patents if competent persons are expected to be retained by the Government in that capacity. These sentiments met a hearty response in the convention, and all who spoke on that subject agreed that the matter deserved the attention of Congress, and expressed a hope that prompt action might be had on it at the next session.

After some general conversation in relation to the report of the committee, it was accepted: and the thanks of the convention were voted to them for the ability and zeal with which they had discharged their duties. The report was then referred to an executive committee of five with authority to bring the amended law before Congress, at its next session, with power to modify the sections; for which purpose, all who are interested can address to either of the committee (post paid) such suggestions and alterations as they may deem expedient. This committee consists of the following gentlemen:—C. M. Keller, and H. Allen, Esqs., of N. Y.; Frederick Emerson, Esq., of Boston; J. J. Greenough, Esq., of Washington, and Jordan L. Mott, Esq., of N. Y.

It was voted, That the Hon. Judge W. Phillips be requested to aid the committee in revising the law, and that they submit it to him therefor. It was also voted, That the executive committee be requested to call another convention at such time and place as they may deem expedient. The convention then adjourned *sine die*.

Circular from the Executive Committee of the Convention.

To Inventors and all others interested in Patents for useful Inventions.

The executive committee, appointed by the convention of Inventors convened in the city of Boston, on the 22d of Sept. last, to take into consideration the best mode of obtaining amendments to the existing law of Patents, were instructed to receive and consider all suggestions that might be submitted to them in relation to the objects of the convention. In accordance with this instruction of the convention, all persons interested in the amendment of the law of Patents are requested to transmit any suggestions which they may have to make on this important subject to the chairman of the executive committee, Charles M. Keller, No. 304, Broadway, New York. All communications by mail to be post paid.

C. M. Keller,
Chairman of the Executive Committee.

FRANKLIN INSTITUTE.

Monthly Meeting, Sept. 16, 1847.

At this meeting the subjects and communications presented, connected with Science and the Arts, were less numerous than on many former occasions.

After the reports of officers and committees, the proposal and election of new members, and other stated business had been concluded :—

Mr. G. W. Smith gave an account of some experiments made by himself, Prof. Cresson, and Mr. Foulke, at the newly erected Berks' County Prison, with regard to the prevention of communication between the prisoners by means of transmitted sound. He referred to the importance of such prevention, in establishments intended to carry out the principle of separate confinement; as well as in asylums for the insane, and other public institutions. In the Eastern Penitentiary of Pennsylvania, where the ventilating flues afforded a medium of communication, an attempt was made to prevent it by the insertion of iron plates, which, however, were found to be objectionable on account of their obstructing the ventilation.

The Berks County Prison, at Reading, is well designed and constructed, and has cost, in its erection, about $55,000. Particular care has been taken to secure a proper ventilation and warming throughout the building. This is attained by means of a tall chimney shaft, with which all the ventilating flues are connected; warm air being communicated to each apartment near the ceiling, and the foul air carried off by an opening into the ventilating flue, near the floor. In order to prevent communication between the prisoners, by means of sound transmitted through these flues, two enlargements are made in them about ten feet apart, in each of which is inserted an earthen vessel having the form of a paraboloid. The sound, falling upon these paraboloids, is reflected in such manner as to destroy its effect. In order to test practically the effect of this improvement, the committee distributed themselves in different cells, and found that, by the utmost exertion of voice, they were unable to make themselves heard from one cell to another. A curious proof of this was afforded by the fact, that after some of them had shouted until they were hoarse, they were visited by others who came from a neighboring cell, to inquire why they had not commenced the experiment of calling to them through the flue.

Referring to other contrivances for this purpose, Mr. S. said that slates, placed in a triangular form in the flues, had been tried in the Pentonville Prison, in England; but he doubts whether this will be found so effectual as the paraboloid. With regard to the expense of this arrangement in the Berks County Prison, he said that the cost of the paraboloid, which is made of common pottery, being but twenty cents, is more than compensated by the saving of masonry consequent upon the enlarged spaces left in the flues for their reception.

Mr. Trego laid before the meeting some specimens of lead and copper ores, which had been recently presented for the cabinet of the Institute. The lead ore was found in the neighborhood of Phœnixville, in Chester County, about twenty-eight miles from Philadelphia. It appears to be chiefly a phosphate of lead, mostly in amorphous masses, though occasionally presenting crystaline forms.* The proprietor is engaged in sinking shafts, in order to ascertain the probable extent and value of this deposit of ore.

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* Since the above notice was written, a specimen of this ore has been analyzed by Dr. M. H. Boyé, of this city, with the following result:—100 parts of it contain, oxide of lead, 75·99; oxide of iron, 4·82; phosphoric acid, 13·56; silica and insoluble silicates, 2·50; water and other volatile matter, 1·25; muriatic acid, and loss, 1·88. It contains 70·53 per cent. of metallic lead.

The copper ore is from an ancient mine in Montgomery County, Pa., near Perkiomen creek, between the Trappe and Sumanytown. A shaft was sunk here, many years since, to the depth of about 100 feet, from which an adit was constructed for the purpose of draining the works. There is a tradition in the neighborhood, that a quantity of good ore was obtained here, when the mine was worked. It has now been neglected for nearly a century; but it is intended to make some explorations, with a view to renewing operations in the mine, if appearances should warrant the undertaking.

A model of a *Rotary Steam Engine* was then presented; upon which Mr. Smith remarked that there were inherent defects in all rotary engines, when compared with those having a reciprocating action. He said the only instance in which a rotary engine might possibly be used with advantage, was for driving, with high velocity, a fan for heating or ventilating purposes, where steam generated for the heating of a large edifice would otherwise be wasted, so far as its motive force is concerned. He remarked that the old Savery form of engine had been found most economical, where the water was to be heated, as well as raised, for the use of public baths, or other purposes, for which warm water was required to be elevated.

A natural curiosity was next exhibited, which excited considerable interest. This was a *Singing Mouse,* which, though declining on this occasion to perform in its best style, yet gave sufficient proof that its musical powers are wonderful, for an animal of its kind. It is a common domestic mouse, (*Mus Musculus,*) and in appearance differs, in no remarkable particular, from other individuals of its species.

It was the musical talent of this little creature which led to its capture. A lady, who kept some canary birds in her room through the day, but who was in the habit of having the cages removed to another apartment for the night, happened to hear, after retiring, a musical chirping in the room, apparently proceeding from beneath a bureau. Supposing that one of her birds had escaped from its cage, and remained in the room, she attempted to dislodge it from its supposed concealment. No bird, however, made its appearance; but a mouse was startled from beneath the bureau, and ran to another part of the room, where it recommenced its song. It was caught and confined in a cage, which it has now inhabited about six weeks; having become quite tame, and evidently recognizing individuals, by showing more familiar regard to its keeper than to strangers.

It is seldom entirely silent, except when sleeping; almost constantly emitting a low chirping series of notes, resembling, somewhat, the twittering produced by a nest of young birds. As the evening advances, its musical disposition is more fully developed, until, usually towards midnight, its notes increase in power, compass, and variety—it then frequently pours forth a gush of melody, resembling the song of a canary bird; but softer and less shrill than the notes of the feathered songster.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA,

FOR THE

PROMOTION OF THE MECHANIC ARTS.

NOVEMBER, 1847.

CIVIL ENGINEERING.

Report of the President and Directors of the Harrisburg, Portsmouth, Mountjoy, and Lancaster Railroad Company, to the Stockholders, September 3rd, 1847.

The Board of Directors of the Harrisburg, Portsmouth, Mountjoy, and Lancaster Railroad Company, beg leave to submit to the Stockholders their Annual Report, showing the condition of the Company on the 1st day of September, 1847, and tabular statements of the business for the past fiscal year.

It will be seen, from the statements annexed, that the receipts of the Company from all sources have been $114,030·47, for the year ending September 1, 1847, being an increase of $20,926·66 over those of the previous year.

Since the last Annual Report of the Directors, the unfinished part of the road has been completed, and the whole line from Dillerville to Harrisburg, has been repaired and put in complete order.

The *Bridges* and *Culverts* along the road have all been kept in good repair. The two stone piers, mentioned in the last report as then being built under the bridge over the Swatara creek, have been finished, and the bridge itself has been thoroughly repaired. This bridge is now in so good a condition, that it will in all probability last for a number of years, with but little, if any, expense to the Company.

The Board have constructed two additional trestles under the Conawago Bridge, taken out a portion of the old timber and replaced it with new, and have relaid the flooring and otherwise repaired and strengthened the structure. The bridge across the little Conestoga Creek, and that over the small canal at Middletown, have both been renewed.

The *Tunnel* near Elizabethtown, the only one on the road, is a well built structure; it is now in good condition and has been kept well drained.

The *Weigh Scales* at Harrisburg and Dillerville, are in excellent order. The old scales at Dillerville were recently taken up, and new ones laid in their place, on granite foundations. These scales were manufactured by Messrs. Ellicott & Abbot, and have proved in all respects equal to those on the Company's road near Harrisburg.

In consequence of the increase of business over the road, the old sideings at Dillerville have been renewed, and a new turnout, over 1500 feet in length, is now in process of construction, which will greatly facilitate the business at that point. There has been a new turnout laid down at Highspire, upwards of 500 feet long. The passenger trains now pass each other at this place, instead of at Middletown, the former passing place. By this new arrangement the morning train from Philadelphia is always enabled to make a considerable gain of time, frequently reaching Harrisburg before the leaving of the afternoon train for this city. The other train (the night line) from Philadelphia, now reaches Harrisburg before the 8 o'clock morning train leaves that place, furnishing, in this way, another important accommodation to the traveling public.

The *Real Estate*, and other property of the Company at Harrisburg, have been much improved since the last Annual Report. The water slips at that place have been cleaned out, and the wharves repaired. Two of the warehouses also have required particular attention; the foundations which had given way have been in part rebuilt, the flooring has been repaired, and part of the superstructure replaced with new timber. New curved tracks have been laid down to all the warehouses. The property of the Company at this place is large and valuable. It is advantageously situated on the Pennsylvania Canal, and will become the place of connexion between the road of this Company and the Pennsylvania Railroad. It now rents for $1950 per annum.

The *Passenger Depot* at Harrisburg will require some alterations and improvements. It is not sufficiently large to accommodate the traveling public, and protect the cars from the weather.

The *Machine Shop* and *Machinery* have been thoroughly repaired. A new and powerful sliding lathe for turning and drilling has been put up, which will greatly facilitate the operations of the workmen.

In consequence of the underwash on the river bank, from the frequent freshets in the Susquehanna, the Board of Directors have found it necessary for the preservation of the road to build a slope wall a considerable distance along the bank of the river. This wall is now nearly completed.

Since the road has been substantially improved and completed, the running time for the passenger trains between Harrisburg and Dillerville seldom exceeds two hours, including stoppages. Previous to this improvement, it was frequently three. This increase of accommodation to the public, has largely promoted the interests of the Company, by increasing the travel over the road. The completion of this work of improvement also enabled the Company to enter more extensively into the transportation of freight, and arrangements were accordingly made for that purpose. It was found necessary from the great increase of business, in the way both of passengers and freight, to procure more powerful engines to do the business of the road.

A contract was accordingly made with M. W. Baldwin, Esq., on the 10th of February last, to build for the Company, a heavy six wheel connecting freight engine, to be finished in time for the commencement of the spring business. This engine, called the Washington, was completed and running on the road in less than five weeks from the period of first making the contract. The work performed by this engine when in use, has been found to be more than equal to any other three of the Company's best engines; while the running expenses of the Washington, for each trip, was but one dollar more than that of each of the smaller engines. The capacity and power of the Washington have fully met the expectations of the Board, and her performance thus far entirely sustains the guarantee of the maker.

Another contract was subsequently made with Mr. Baldwin, for an eight wheel engine, with four driving wheels connected, combining both power and speed, to be used for passengers and freight.

This engine was placed on the road, the 22nd of August last; it has not as yet been sufficiently tried to test its power and speed. The Board, however, have no doubt its performance will prove quite as satisfactory as the other, for the purposes intended.

The cost of these two engines is $14,093. Two of the old engines, being no longer needed, have been disposed of. The other locomotives belonging to the Company, six in number, are all in good order, and will require but little repair for the coming year.

The Board of Directors take great pleasure in being able to make an exhibit to the Stockholders of the financial affairs of the Company, in their present greatly improved condition. The difficulty and embarrassments, under which they labored for a long time, have been almost entirely removed. The debt due the Messrs. D. & J. Salomons of London, which was secured by the assignment, has been paid off, and the lien removed. The Trustees under this assignment, have therefore been enabled to restore to the Board of Directors, the control of the property and income of the Company, which are now under their exclusive management and direction. This important arrangement was accomplished in June last, by borrowing $40,000, at an interest of 6 per cent. payable in ten instalments of $4000 each; the last falling due on the 15th of June, 1848. Two of these instalments, amounting to $8000, have been already met at maturity. After applying the proceeds of the above loan to paying the claim of the Messrs. Salomons, amounting to $36,072·29, the balance was paid to Messrs. Betts, Pusey, & Harlan, in satisfaction of a judgment which they held against the Company.

The Directors are unwilling to let this opportunity pass, without expressing their thanks and those of the Stockholders, to the Trustees (Messrs. Fraley, Lex, and Linnard), for their faithful discharge of the duties devolving on them by virtue of the trust referred to, and for the courtesy and fairness which has characterized their intercourse with the Board, during the whole time of its existence.

In reference to the business of the road for the past year, the Board believes that the Stockholders have great reason to congratulate themselves with the result. Although the general expenses may appear large, they will bear in mind, that since the last annual report, the Board of Directors have purchased two new and powerful engines at a cost of over $14,000, which are worth that money at the present time; they have also paid near $3000 damages for using patent curves. It will further be seen, by the last year's report, that the expenses for August, 1846, were not included in the current expenses of the last fiscal year. The new track, which was not then finished, has been since completed at a cost of upwards of $20,000. These extra expenses, amounting to more than $36,000, should not be estimated in the ordinary expenses of the road.

The great objects for which the Board have been for a long time anxiously laboring, have been accomplished; viz., the renewal and improvement of the road, and the raising of the assignment. The Company is now enabled to work the road at much less expense than formerly; and in addition to this, the business over it has increased and must still further increase largely; so that hereafter there will be, from the profits of the road, a considerable surplus left after paying the current expenses and the interest on the loans. This surplus, the Board think, should be applied to the liquidation of the present floating debt of the Company, amounting to only $47,000. Having accomplished this desirable result, regular dividends of the profits to the Stockholders may be expected, without any apparent probability of their interruption for the future.

An energetic commencement has already been made in the construction of the Pennsylvania Railroad; and as the value and importance of the road belonging to this Company is greatly increased by the connexion with that great undertaking, the Board beg leave to refer the Stockholders to the 11th section of the Act of Assembly, passed April 13th, 1846, incorporating the Pennsylvania Railroad Company; which section provides for the connexion of that road with this Company's road, in the following words:

" Beginning at and uniting with the western terminus of the Harrisburg, Portsmouth, Mountjoy, and Lancaster Railroad, in the borough of Harrisburg, provided said Harrisburg, Portsmouth, Mountjoy, and Lancaster Railroad Company shall be subject to, and consent to the same rate of tax on tonnage, for the use of the State, as is provided to be paid in this act by the Pennsylvania Railroad Company; and in case the said Harrisburg, Portsmouth, Mountjoy, and Lancaster Railroad Company should not agree to comply with these conditions within three months after the distance of fifteen miles from Harrisburg, westward, shall bona fide be put under contract, the said Pennsylvania Railroad Company are authorized to connect this road with the Columbia Railroad, at or near the borough of Columbia, in Lancaster County," &c.

At a stated meeting of the Board of Directors, held July 2nd, 1847, the above provisions of the 11th section of the said act were laid before the Board; and at a subsequent meeting, held August the 28th, the following preamble and resolutions were read and taken up for consideration, viz.:—

Whereas, the Act of the General Assembly of Pennsylvania, passed the 13th of April, 1846, incorporating the Pennsylvania Railroad Company, provides, in the 11th section thereof, that the consent of this Company shall be given to certain conditions therein referred to, within a specified period: and whereas, the Board of Directors of the Pennsylvania Railroad Company, did, on or about the 15th day of July, 1846, bona fide, put under contract the distance of fifteen miles of the said road from Harrisburg, westwardly, therefore,—

Resolved, That the Harrisburg, Portsmouth, Mountjoy, and Lancaster Railroad Company hereby consents to be subject to the same rate of tax on tonnage, for the use of the State of Pennsylvania, as is provided to be paid by the Pennsylvania Railroad Company, during the same periods and under the same terms and regulations as is provided in the Act of the General Assembly of the State of Pennsylvania, entitled, "An Act to incorporate the Pennsylvania Railroad Company," passed the 13th day of April, A. D., 1846.

Resolved, That the President of this Board be and he is hereby directed to inform the Secretary of State, and the President of the Pennsylvania Railroad Company, of the consent of the Harrisburg, Portsmouth, Mountjoy, and Lancaster Railroad Company, granted by the foregoing resolution, and to furnish them with copies thereof, to be respectively laid before the Governor of the Commonwealth, and the Board of Directors of the Pennsylvania Railroad Company.

Whereupon the following resolution was unanimously adopted:—

Resolved, That the foregoing preamble and resolutions be referred to the Stockholders at their annual meeting on the 3rd of September proximo, with the recommendation that the same be adopted by the Stockholders.

All of which is respectfully submitted.

By order of the Board of Directors,
September 3, 1847. JOSEPH YEAGER, *President.*

Statement of the whole Receipts and Expenditures of the Company for the Fiscal Year, commencing September 1*st*, 1846, *and ending August* 31, 1847; *also with the balances of Cash on hand, taken from the Accounts of the Trustees, to the* 1*st of June last, from the former and present Treasurer, and the Superintendent.*

To balance in hands of Trustees, 1st Sept., 1846,	$ 386 07
To balance in hands of Treasurer, 1st Sept., 1846, .	4,779 70
Carried over,	$5,165 77

Brought over	$ 5,165 77
To cash received by Trustees to 1st of June last, from passengers, freights, mails, rents, &c., .	84,266 91
To cash received in June, July, and August, for passengers, mails, rents, and freights, &c., . .	26,584 09
To cash for sale of old materials, . . .	3,179 47
To cash from loan to remove the assignment, .	40,000 00
	$159,196 24

Disbursed as follows, viz.:

By cash paid interest on Company's loans and debts,	$35,426 86
By cash paid discount on uncurrent money, .	201 83
By cash paid this amount of Company's debts,	52,404 17
By cash paid on account of new locomotives, .	3,500 00
By cash paid for repairing and running the road for 13 months, per statement, ...	34,877 16
By cash paid by Superintendent for materials and labor in reconstructing road, ...	20,051 81
By cash paid insurance on property and taxes, . .	1,349 10
By cash paid salaries, President, Treasurer, Secretary, office rent, stationery, &c., ...	3,438 60
By cash paid damages, Attorney's fees, &c., . .	3,333 91
By cash paid expenses of Trust to 1st June, . .	1,600 00
By cash paid old debts, ...	20 00
By balance in hands of Treasurer, ...	2,992 80
	$159,196 24

Abstract of Freight Business.

MONTHS.	Tolls Eastward collected at Harrisburg.	Tolls Westward, collected at Dillerville.	Whole Amount.
1846. September,	$ 877 63	$1,256 27	$2,133 90
October,	976 26	1,083 12	2,059 38
November,	1,194 99	748 71	1,943 70
December,	1,211 89	865 91	2,077 80
1847. January,	1,804 61	1,149 77	2,954 38
February,	2,800 94	1,846 84	4,647 78
March,	2,652 94	2,987 41	5,640 35
April,	1,435 12	1,415 96	2,851 08
May,	966 32	913 00	1,879 32
June,	1,000 03	844 92	1,844 95
July,	472 16	537 54	1,009 70
August,	385 19	534 45	919 64
	$15,778 08	$14,183 90	$29,961 98

Abstract of Passenger Business.

MONTHS.		Miles traveled by Passengers.	Equivalent of through Passengers.	Average Receipt from each Passenger.	Whole Amount from Passengers.
1846.	September,	164,234	4,562	$1 40	$6,386 85
	October,	182,304	5,064	1 40	7,089 59
	November,	128,065	3,557	1 40	4,980 34
	December,	85,577	2,377	1 40	3,326 95
1847.	January,	97,170	2,699	1 40	3,778 85
	February,	91,139	2,531	1 40	3,544 29
	March,	162,474	4,513	1 40	6,318 45
	April,	235,948	6,554	1 40	9,175 77
	May,	191,332	5,314	1 40	7,440 63
	June,	188,090	5,224	1 40	7,314 54
	July,	157,332	4,370	1 40	6,118 46
	August,	172,917	4,803	1 40	6,724 54
		1,856,582	51,568		$72,199 26

Abstract of Receipts from Passengers, Freights, Rents, Mails, &c., &c., for the past year.

Receipts from Passengers, ...	$72,199 26
Do. Freight, ...	29,961 98
Do. Mails, ...	6,300 00
Do. Rents, ...	1,850 00
Do. extra Freight and Baggage, . .	539 76
	110,851 00
Receipts from sale of old materials, during the year,	3,179 47
Total income for year, .	$114,030 47

This statement shows that the receipts for passengers are $72,199,-26, equal to 51,568 through passengers, at $1·40 each.

The eastward tolls on freight amount to . .	15,778 08
The westward tolls on freight amount to .	14,183 90
	$29,961 98

The following statement shows the amount and character of the Company's loans and debts, viz.:

Five per cent. sterling bonds, sold in London, redeemable in 1858, £64,500 at 4·85, . .	$312,825 00
Six per cent. bonds and debts funded until 1858, in the United States, ...	258,582 45
Carried over,	$571,407 45

Brought over,	$571,407 45
Unfunded debt, ...	46,602 70
	618,010 15
Unclaimed interest due, ...	450 00
	$618,460 15

A Statement of the General Expenses of the Company from 1*st August,* 1846, *to* 1*st September,* 1847 (13 *months*), *including the Amount expended by the Superintendent for Repairs, Materials, Workmen, and Reconstructing Road, &c., &c.*

1. Repairs of roadway, bridges, culverts, and superstructure, between Elizabethtown and Dillerville,		$2,534 05
2. Repairs of roadway, bridges, culverts, slope-wall, and superstructure, between Elizabethtown and Harrisburg, ...		6,883 93
3. Repairs and improvement of depôt, machine shop, warehouses, water slips, water stations, and new weigh scales, &c., &c., ...		1,213 16
4. Repairs of locomotives, tenders, and construction of new turning lathe, ...		4,640 04
5. Repairs of baggage and passenger cars, &c., &c.,		1,189 96
6. Expense of wood, ...		4,357 88
7 Expense of coal, ...		706 43
8. Expense of oil and cotton waste, . .		940 38
9. Wages of engine men and firemen, . .		4,508 25
10. Wages of laborers engaged in pumping water, tending switches, sawing wood, watching depôts and bridges, ...		3,085 88
11. Expense of carrying mail to post offices, . .		250 00
12. Salaries of superintendent, collectors, and conductors,		3,549 81
13. Hire of locomotives and cars to D. Lapsley, trustee,		1,017 39
		34,877 16
14. Amount paid by superintendent for materials and labor in reconstructing Company's road, ...	$20,051 81	
15. Insurance on property and taxes,	1,349 10	
16. Salaries of president, treasurer, and secretary, with office expenses, rent, printing, and stationery, in Philadelphia and Harrisburg, ...	3,438 60	
17. Damages, attorney's fees, and legal expenses, &c., ...	3,333 91	
18. Expenses of trust, paid trustees and secretary to 1st June last, . . .	1,600 00	
19. Old debts paid, incurred prior to 7th September, 1842, ...	20,00	
		29,793 42
		$64,670 58

Explosion of the "Cricket" Steamboat, on the Thames.

The Cricket was a small steamer, running between the Adelphi Pier and London Bridge, at the fare of one halfpenny for each passenger. She had already made two passages, and was lying off the pier, about to start on her third trip, when the accident occurred. There were about 150 passengers on board at the time of the explosion, who were quietly seated, awaiting the departure of the boat. Five were killed, and forty or fifty greatly injured. We extract, from late London papers, the following report and testimony concerning the supposed cause of this frightful accident.

An examination of the wreck has been made by Mr. Elijah Galloway, civil engineer, of Buckingham Street, whose report is as follows:—

"There are two boilers abreast of each other, one of which (the starboard boiler) exploded. The boilers are tubular, the fire being placed in a large tube, say of three or four feet in diameter, within the boiler, and therefore surrounded by water. The flame or heated air is returned to the front of the boiler, by about 60 or 70 tubes, of about two inches diameter, and it is the use of these small tubes that gives the boilers the name of 'tubular.' The chief advantage of these boilers is, that a larger heating surface is obtained in a smaller space, than when the old fashioned flues were exclusively used. Tubular boilers have recently obtained very general use, both in the Government and mercantile marine, though not in many instances to generate what is termed high-pressure steam, for steam vessels. It is by no means to be concluded, however, that there is any peculiar danger in the use of high-pressure steam in steam vessels, any more than in locomotives, the latter of which can necessarily be worked only by high-pressure steam; and, although it is believed the ordinary pressure generally much exceeds that which it is alleged these boilers worked, the explosion of a locomotive boiler is very rarely heard of, and is, indeed, a casualty now considered all but impossible.

"The explosion seems to have commenced by the separation of the front plate, (into which the fire-tube and the smaller pipes are fixed,) from what is termed the shell of the boiler. The dome, which is a sort of reservoir placed over the shell, is also separated, and has not yet been found, although means have been taken to recover it; because, without it, it is difficult, and perhaps impossible, to ascertain whether the dome was blown off by the force of the steam, or separated by the flight of the boiler towards the stern. It appears evident that, upon the separation of the front plate, the shell of the boiler flew away from the front plates and tubes in one piece, like the shell of a rocket, the front plates and tubes being propelled in an opposite direction, against the framing of the engine, as is demonstrated by considerable indentations on the front plate, and corresponding with similar marks on the framing of the machinery. But for the interruption thus given to the progress of the front and tubes, the fore cabin, and the passengers on the fore deck, must have shared a similar fate to those on the after deck. The progress of the shell of the boiler is clearly shown to have been in a direction nearly aft, or rather taking a course slightly inclined from the starboard to the larboard side, cutting through the iron bulkhead, through the timbers, and finally opening a passage through the run of the vessel, cutting most, if not all, the angle irons, which form what would be the timbers of a wooden vessel, dividing the rudder post in three pieces, and laying the two sides of the vessel, which were nearly vertical, almost flat.

"The funnel and the outer casing around the boiler, being made of weak iron, appeared to have been blown upwards from the pressure of escaped steam from the boiler, the force of which they were totally inadequate to resist. The funnel and the casing carried away the bridge between the paddle-boxes, or gangway, on which the captain stands, and fell alongside into the water.

"The small tubes of the boiler are comparatively uninjured, only two of them being slightly bent, and this most likely arose from the forcible detachment of the front plate. The tubes of the upper range are found to be covered with the usual incrustation or deposit from the water. Their condition indicates that the accident did not arise from any lack of the proper supply of water in the boiler."

We believe that a saving of not less than one ton of coals per day is gained by the description of engines used on board the Cricket, Ant, and Bee steamboats. The boilers of the Cricket were three-eighths of an inch thick in every part except the steam chest or dome, which was five-sixths of an inch thick. The tube plates were three-quarters of an inch thick. The boiler case was 6 feet 6 inches long, the fire-tube 2 feet 6 inches, and the smaller tubes one-eighth of an inch thick.

The inquiry into the cause of death of the unfortunate persons who lost their lives, in consequence of the fatal explosion of the Cricket steamboat, was resumed on Tuesday morning, by Mr. Bedford, coroner for Westminster, in St. Martin's workhouse. The coroner stated, that he only proposed to-day to proceed with evidence as to the names and interests of the proprietors of the company. When the engineering evidence was complete, he would proceed with it.

Jacob Edwards examined: I live in Ratcliff Highway, and am a stoker. I was employed towards the latter end of June, 1846, on board the Cricket, and I remained in her six weeks. I know that during the time I was on board the Cricket, the engine was on the high-pressure principle. Mr. Clarke succeeded in April last as engine driver. After Clarke had been there some days, the boat began to lose speed very much. Complaints were made, both by the captain and the superintendent, that the speed of the boat fell off, and I was frequently asked the reason. In consequence of those complaints, Clarke tied down the safety valves by a piece of spun yarn from the lever, with the aid of nails, both on the larboard and starboard side. They were tied to the lever outside of the weights, and the string was brought down in front of the boiler, and fastened to spike nails in a beam that was above it. The string was brought down so tight, it was impossible for the valves to act. The valves were almost continually in that position for upwards of a fortnight. By chance he (Clarke) let them up at the side of the pier, but never when the vessel was under weigh. I have frequently set them at liberty myself, when Clarke's back was turned; but whenever he came on board again, he immediately closed them up again, tied them, and found fault with me for letting them go. I frequently observed to him that something would occur, unless he minded what he was about, and he invariably told me that his life was as sweet as mine, and to mind my own business, and that I knew nothing about it. I often spoke to the captain about it, and the captain spoke to me; he said, "What would be the consequence if an explosion took place?" and I told him that we would all be blown up. I left the Cricket in the month of April.—Two friends of Clarke's came on board, and brought some gin; and, after the gin had been drunk, he sent me ashore for another pint. Upon returning with the gin, I observed to Clarke, that, if he did not ease the valves, they would all be blown up. On that Sunday, I heard some noise in the boiler, as if plates were shaking against each other, and I called Clarke's attention to it. I begged of him to let the valves go, as there were a great number of persons in the vessel, whose lives were in danger, as well as the lives of ourselves. Clarke refused to untie them, and I immediately let them go, but he made them fast again. He again told me to mind my own business. I noticed that when the mercury gauge, which was usually at 40 or 44, had got beyond that point, we could not tell the pressure that was on. I never heard or knew what pressure the engine was intended to bear. Forty pounds was the general pressure. When there was a pressure of forty on the valve, the valve would rise. I have nothing more to state, but that I have seen Clarke, not content with tying the valves, but I have seen him put a fire bar, weighing about 14lbs., in order to keep them down, in case the hemp should burst. This was when the valves were tied down. Clarke and myself had words frequently about the valves being tied down, but it did not create ill-will, except that the valves were tied down improperly, and he said that the boat must be kept going, and he must do so. I told the proprietors about it. On coming on board on the Sunday, I took the opportunity of Clarke's absence to ease the valves, and on the next day I left the Cricket, and went on board the Bee. I was discharged on the Saturday following, by Mr. Butters, who brought me word that I was to be discharged. I went afterwards to the proprietors, to know why I was discharged, when I was told that I was discharged on account of the oration that I had made on the Sunday previously, and I answered that I should be commended, instead of being discharged, because, sooner or later, I knew there would be an explosion. I told Mr. Smith, one of the company, that the valves had been tied by Clarke, and that an accident would occur. Mr. Smith told me that, as I had made an oration on board of the vessel, in presence of a great number of people, I was discharged. Mr. Montague Chambers cross-examined this witness, as did also two other barristers, engaged by parties connected with the company. The Government had no legal representative. Nothing was elicited, however, from the witness, contradictory to his statements, and his evidence was followed by that of

William Williams, Ashford, Kent, engineer, who said, I am not acquainted with any of the parties interested, but I volunteer my evidence. About two months ago, I was a passenger on board the Cricket steamboat, and on looking over the casing from the deck, I observed that one of the plates covering the valve was removed, and that a line of spun yarn was fast over a beam, in an oblique direction. I remarked this matter to my brother, and said that the valve was tied down. The boat was then running. I observed it for about three minutes. This course was contrary to the usual practice. The brother confirmed the evidence. Mr. Rede, musical instrument maker, and others, also proved the safety valve was tied down with string.

William Warren, engineer of King's College workshop, proved not only the same fact, but that he had, at the time, called the attention of the engineer to the matter. I have often been on board the Cricket steamboat. After the explosion, he mentioned what he had seen to Professor Cowper, of King's College, at whose instigation he gave evidence.

Joseph Buttriss, Greenwich, fitter, in the employ of Mr. Joyce, deposed that he had been occasionally driving the engines of the Cricket; found that the valves had been tied down by Clarke, and that it was because the stoker Edwards would not deny this, he was discharged. The coroner said this was all the evidence he intended to take at that time, and adjourned the inquest until the same time next day.

On Wednesday morning, at the adjourned inquest, the evidence produced were principally servants of the company, in which it was endeavored to disprove the evidence of the stoker Edwards, and to give him a bad character. The course was, however, unsuccessful; and, after the examination of Martin, the captain of the Cricket at the time of the explosion, the inquiry was adjourned until Saturday. The coroner complimented Martin on the manner in which he gave his evidence, and regretted that the other witnesses had not given their evidence in the same straightforward manner.

The Britannia Tunnel Bridge over the Menai Straits. General Pasley's Letter, and Mr. Stephenson's Reply.

General Pasley addressed lately a letter to the Times in which he made the following statements in reference to this structure; we give them in a somewhat abridged form:

As it is well known, that when examined before a select committee of the House of Commons on the sixth of May, 1845, on the means of passing the Chester and Holyhead Railway over the Menai Straits, I approved of the tubular bridge then proposed by Mr. Robert Stephenson, engineer of that company, I think it is a duty to myself, if not to the public, to offer some observations on the various projects for effecting the same object, successively brought forward by him of which that alluded to was the second.

In his first plan, February, 1845, Mr. Stephenson proposed to throw a massive substantial bridge, with two segmental cast-iron arches, each of 350 ft. span, over the Menai Straits, having a clear height above the water, of 116 ft. in the centre, and of 50 ft. at the springing of each of those arches, which were to be supported by an intermediate pier of masonry 120 feet wide, on a shoal called Britannia Rock, and on two abutments, also of masonry. His plan of operation for putting the pieces of iron for his arches together successively, so as to balance each other, by working outwards from the upper part of the pier and of the abutments, until his semi-arches should meet at the centre of each opening, seemed to me to be crude and ill-digested at the time, and either impracticable, or nearly so. I gave Mr. Stephenson my opinion, that, in consequence of the impossibility of obtaining any support from below, a suspension bridge, such as that previously erected by Mr. Telford over the same straits, which being everywhere 100 feet high, offers no impediment to the navigation, and having in its present state strength enough to bear the heaviest railway train, but not with safety, owing to the flexibility and extraordinary undulations of the roadway in a gale of wind, might be rendered efficient for all railway purposes by four vertical trusses, one on each side of the two lines of rails, which, if of sufficient depth, would produce that rigid inflexibility of roadway, without which no railway bridge can be constructed safe; a principle first adopted by Mr. Tierney Clark in the construction of the suspension bridge at Hammersmith, and more recently by Mr. Rendell, with no less success, in his repairs of the suspension bridge at Montrose, after one-third of the roadway had been carried away by a storm, on the 11th of October, 1838. I further suggested to Mr. Stephenson, that a suspension bridge for passing a railway over the Menai Straits might be trussed to advantage by wrought-iron lattice work, such as Sir John MacNeil had adopted for passing the Dublin and Drogheda Railway over the Royal Canal near Dublin, by a bridge of 140 ft. span. Afterwards the Lords of the Admiralty employed Sir John Rennie, and Mr. Rendell, civil engineers, and Captain Vidal, R. N., to examine that part of the Menai Straits where the railway bridge was proposed, and to consider what conditions they thought necessary to prevent the navigation from being injured. On receiving their report, the Admiralty required that the Chester and Holyhead Railway Company, in making their bridge over the Menai Straits, should not construct the central pier on Britannia Rock wider or longer than 50 ft., and that there should be two openings between it and the abutments, each 450 ft. in clear width, and everywhere to be of 105 ft. in clear height above high water level.

Mr. R. Stephenson's second plan, when thus obliged to withdraw the former, was to erect a suspension bridge of the usual construction, in order to obtain a platform for his further operations as I had before suggested. But the sort of bridge which he now proposed to put together by this means was of a novel and very ingenious construction, consisting of two large tubes of boiler iron elliptical in section, and each measuring 30 ft. by 15, in clear height and width; and he proposed that these tubes, though resting on a central pier of masonry, were to pass entirely across the straits from one side to the other. Observing the conditions prescribed by the Admiralty, it is evident that they could not be much less than 1000 feet in length, when finished.

On the 5th of April, and afterwards on the 6th of May, 1845, Mr. R. Stephenson admitted, in examination before the Select Committee of the House of Commons, that the above was the only possible mode of throwing a bridge of such large openings over the Menai Straits, but he had so much confidence in the strength and rigidity of his proposed tubes, that, after they should be placed he thought the suspension apparatus might be removed with safety. When I was examined by the same Committee, on the last-mentioned day, I gave my opinion that the tubular bridge proposed by him would be strong and safe; and that when properly fixed, it would not be injured by gales of wind, though I was not convinced that such tubes would be better than vertical trusses; but I differed entirely from the suggestion Mr. Stephenson had thrown out, as to the expediency of removing the suspension apparatus—a measure which I thought would not only be unnecessary, but that it might endanger the security of the bridge.

From this, his second project, Mr. Stephenson has since departed, having been induced to give up elliptical and adopt rectangular tubes, in consequence of experiments tried, at his request, in 1846, by Mr. W. Fairbairn, and Mr. E. Hodgkinson, both very experienced and skilful in the uses of iron, as applied to practical architecture and engineering. Not so, the decision afterwards adopted by Mr. Stephenson, of abandoning the suspension principle altogether; instead of which he now proposes to put together in succession each of his tubes, which, according to this new arrangement, will be four in number, on a bridge of boats, which will first be formed parallel to the shore, and will then be swung into the proper transverse position by the quarter circle movement, common in the practice of military bridges, after which the tube is to be suspended by chains; and though either of the sides will expose to the wind a surface of at least 1400 square ft., considerably exceeding the area of all the sails of a 28 gun ship, and will weigh, as I am told, about 1200 tons, each of these unwieldy masses is to be raised up nearly 100 feet by hydrostatic pressure, and thus deposited and fixed on the lofty pier and abutment of masonry. I feel it my duty to express my entire dissent from this rash, if not impracticable, plan of operation, which cannot even be attempted without the risk of some very serious disaster, except at the high water slack of a neap tide, and in a perfect calm.

He has now, to my knowledge, proposed three projects, which have just been described, all widely differing from each other, for passing the Chester and Holyhead Railway over the Menai Straits; and I think that his second plan, the only one which I approve, would have been sufficiently arduous in itself, without adding to the difficulty, and diminishing the safety of the attempt, by the abandonment of the suspension principle; if he persists in this, his third plan of operation, the chances are, that the first tube which he attempts to raise will find its way to the bottom of the straits.

Since the publication of General Pasley's letter, there has been a meeting of the Chester and Holyhead Railway Company, at which Mr. Stephenson replied to the General in the following terms. We quote the Railway Record's report:

General Pasley makes only a statement, or rather gives a detail, of conversations which took place between us relative to the principle of the use of iron-tube bridges. General Pasley states at first he approved of the principle adopted by me, and there is not in his letter one paragraph to condemn that principle—nay, he distinctly repeats that he approves of the principle. What he complains of is the mode of erecting the tube. Now, Gentlemen, there are only two or three persons who know the facts connected with the mode proposed, and General Pasley cannot possibly be in possession of any information which can at all justify his prediction. (Hear, hear, hear.) The original plan was to use chains to raise the tube to a level with the platform of the railway, which chains could be removed when the tube was fixed. Afterwards, we altered the mode of raising the tube; and it is only to this mode about which General Pasley cannot know anything—for, as I have said, it has been confided only to two or three persons—that objection is taken. I believe any apprehensions that may be entertained are of a very vague character, and that it is mainly the novelty of the plan which gives rise to such apprehensions. I believe the objections have nothing in them; the plan is only an application on a gigantic scale of an old principle.

I beg to say, Gentlemen, that they have created no apprehension whatever in my mind; they have not altered my convictions in the slightest degree; and though, as in all great works, difficulties doubtless will arise in the course of their execution, these difficulties, I am satisfied, will only be such as will suggest the remedy as they occur. (Hear.) I believe nothing will occur which we shall not be able to correct. I shall myself be on the spot; and I repeat, that though I never knew any great work of any kind in which difficulties have not arisen, I entertain no doubt that in this case they will be readily surmounted. (Hear, hear.) I beg, therefore, that the proprietors will dismiss all apprehensions on this point from their minds. The scheme involved long and experimental investigations, exceeding anything that had ever taken place before; but I felt that a large expense was fully justified to test and settle the details of the bridge. (Hear, hear.) I believe we have so settled the matter; and I have reason to know that the most eminent engineers and mathematicians approve of the principle. (Hear, hear.)

Mr. Henman had understood General Pasley's objection to be, that Mr. Stephenson now intended to abandon the suspension principle which he had originally fixed upon. Now, he would be glad to know if Mr. Stephenson was of opinion that the tube, being of so large a span as 450 ft., would be able to bear the trains, and withstand the vibration, without support from chains at intermediate points.

Mr. Stephenson.—I wish it to be distinctly understood that I never designed the chains should form an essential part of the permanent structure; they were originally proposed, not for supporting the tube, but for raising it. As we proceeded, I found that, by increasing the weight and size—or rather, I should say, the weight only, for the size has never been altered—we could dispense with the chains altogether; I believe that it may be looked upon as fully settled, that, as respects the strength of the bridge, the chains would rather be a deterioration than otherwise. As regards vibration, there are certainly various opinions; but, for my own part, I think that no vibration at all will be felt. (Hear, hear, hear.) My reason is, the relative ratio of the weights of the tube and the trains. Take, for instance a train of even 100 tons, then, as the tube is to be 1200 tons weight, I ask whether with such relative weights, the tube is likely to be thrown into vibration? I say it is impossible. If the ratio of weights were reversed—if, for instance, the train should be 1200, and the tube 100, such vibration would, undoubtedly, arise. I believe that the tube will be as firm as a rock—that it will suffer no vibration at all; at least, not more than everything does over which a train passes. (Hear, hear.)

We quote the following description of this stupendous work, in its present state of progress, from the letter of a correspondent of the Manchester Examiner:

If we suppose ourselves stationed in a boat in the middle of the Menai Straits, a few hundred yards distant from the new bridge on the south side, and suppose it finished, we shall see a wonder of the world of this kind. First, there is the middle pier rising out of the water, founded on the Britannia Rock, after which the bridge is named. This rock can be seen at low water. The breadth of this pier is 62 ft. by 53 ft. and a quarter of an inch. The blocks of stone are 7 and 8 feet long by 3 and 4 ft. in breadth and deepness, and they rise stone upon stone, until the pier is 230 ft. high. At the distance of 460 ft. on each side of this centre pier there rise, near the water's edge, two other piers of the same gigantic breadth and height; while on each side of these two piers, at the distance of 250 ft., there rise two walls. Continuing outwards, the wall on our right hand, on the Carnarvon shore, does not extend its ponderous bulk far back, for the land is high and bold, and the railway comes along its elevated brow, and at once lays hold of the bridge. But on our left hand, which is the Anglesea shore, the wall is the forehead and end of a mighty embankment, on which the railway is raised to the level of the bridge. There, then, are the four spaces before us, across which, in the iron tubes, the railway is laid, namely, two spaces on each side of the centre pier, of 460 ft. each (let the reader measure 460 ft. on a street or on a road, and he will wonder at the vastness of this structure); and two more spaces, of 250 ft. respectively, at each end. The tubes are eight in number, each of them 30 ft. on the exterior side, and 27 ft. high in the interior. Each is 14 ft. wide, and they are laid in couples parallel to each other. In the whole, with the breadth of the piers and the landward buildings, the length of the bridge is one-third of a mile. In height, the three piers are, as already said, 230 ft. Measuring from low-water mark to the bottom of the tubes, the height is 130 ft., the tubes being 30 ft. on the side, and the pier 70 ft. above their upper surface. As ornaments to the two walls which rise upon each shore, are four lions, two at each end of the bridge. The lions contain about 8000 cubic feet of stone. They lie couched, and yet the height of each is 12 ft.; the greatest breadth across the body is 9 ft.; the length 25 ft.; the breadth of each paw 2 ft. 4 in. The tubes are made of plates of iron of various thicknesses, riveted together. The iron increases in thickness as we proceed towards the centre. The roofs of tbe tubes are formed of cells, and also the floors. These cells are formed of iron plates set on edge, the cells of the roof being within a fraction of 1 foot 9 inches square, and those of the floor being 1 foot 9 inches wide, and 2 ft. 3 in. deep. The rails on which the trains run are laid on the cells of the floor. The flat bottom, the two upright sides, and the flat roof of each tube are formed of plates, the thinnest of which is a quarter of an inch, and the thickest, three quarters of an inch. The weight of each of the four long tubes will be about 1300 tons; the weight of each of the four short ones, about 600 tons. In the whole there will be at least 7600 tons of iron used. The masonry was contracted for by B. J. Nowell and Co., at £130,000; but, from alterations in the plans, it will cost £200,000. They expect to finish the masonry by August, 1848. It will contain 1,500,000 cubic feet of stone.

Lond. Mec. Mag.

AMERICAN PATENTS.

List of American Patents which issued in the month of August, 1846,—with Exemplifications, by Charles M. Keller, *Agent for procuring Patents, and late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in the Rat Trap;* Levi Kittinger, East Grinville, Ohio, August 8.

Claim.—"What I claim as my invention, and desire to secure by letters patent, are the sliding gates, double inclined planes, and stirrup lever, and their combination with the treadle, double-sweep crank weight, pulleys, rockers, slides, and springs, as herein described, forming and constituting my trap, and by which my trap sets itself, until the weight is run down."

The sliding gates are so combined with a double inclined plane, lever crank, and treadle, as to reset the trap, by means of a weight, which requires to be wound up at intervals, like a clock.

2. For *Improvements in the Mill for Crushing Sugar Cane;* Alfred Stillman, City of New York, August 8.

The patentee says,—"The usual method of crushing cane, is to pass it between rollers, arranged with two on one horizontal plane, and a third making pressure on one between them, and, as the cane is of a spongy texture, the moment it is relieved from the pressure of the rollers it expands, and takes up much of the saccharine matter, by suction and capillary attraction, and, to avoid this difficulty, a second set of rollers have been combined with the first set, to re-crush the cane, after it has passed from the first; but experience has demonstrated that this will not do, for after the cane has been crushed, by passing between the first set, it forms a very thin layer, which, if passed to the second set in that condition, will be ground or cut through by the pressure of the rollers, instead of being simply crushed or squeezed, to throw out the saccharine matter. To obviate this difficulty, is the object of my invention, which consists in so connecting the two sets of rollers, as to cause the crushed cane to pass to the second set, in a considerable body or thickness, to prevent the rollers from cutting or grinding it through, by so combining the two sets of rollers, as that the cane shall be presented to the second set, in a body much thicker than when delivered by the first set."

Claim.—"I do not claim as my invention, the combination of two sets of rollers, to crush and re-crush sugar cane, as this has heretofore been essayed; but what I do claim as my invention, and desire to secure by letters patent, is so combining them, as to present the cane, after it has been crushed by the first set of rollers, to the second set, in a body much thicker than when it left the first set, the more effectually to express the saccharine matter, and to prevent the second set of rollers from cutting through the mass; the whole being effected on the principle substantially as herein described."

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3. For *Improvements in Machinery for Spinning;* Geo. E. Warring & R. E. Peterson, administrators of Alex. S. Walcott, deceased, and John Johnson, City of New York, August 8.

Claim.—"What we claim as our invention, is the forming the bobbin on the tube carrying the bobbin, or the tube itself, or the tube and bobbin combined, in such a manner, that the upper bearing at the upper end of the tube or bobbin shall be against the spindle; and the lower bearing, laterally, shall be against a fixture on or in the rail below, as described, or against a lateral bearing on the rail itself, the bobbin or tube not having any other bearing except at its two extremities. And we also claim as new, and of our invention, the placing of a roller in front of the drawing roller, and revolving the same in the direction of the arrow, and the use of the same in connexion with spinning fibrous substances."

The object of the roller referred to in the second section of the claim, is to assist in carrying up the twist. It is placed forward of the last draw roller, and the thread passes over it on its way to the flyer; the said roller being made to rotate about ten times as fast as the last draw roller.

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4. For an *Improvement in the Enema Chair;* Wm. Laighton, Portsmouth, New Hampshire, August 8.

The patentee says,—"The principal object had in view, in the manner of constructing my enema chair, is so to arrange the apparatus, as that the person using it may, without rising from the seat, remove an injection pipe and its appendages, and make use of a pan which is combined with the chair; thereby rendering the use thereof more convenient than under any previous mode of constructing such apparatus."

Claim.—"Having thus fully described the manner in which I construct my enema chair, and shown the operation and use of its respective parts, what I claim therein as new, and desire to secure by letters patent, is the manner herein set forth, in which I combine the injection pipe therewith, so that it may be removed, after being used, whilst the person retains his seat—the arrangement and combination being substantially the same with that herein described."

5. For a *Cure for Hernia, called the Appilative;* Ovando Hurlbut, Buffalo, New York, August 8.

The patentee says,—"The nature of my invention consists in constructing an appilative composition, in the shape of the truss pad, to apply to ruptures, which composition gradually heals the parts, and continues to flatten down, by the heat of the body, as the cure proceeds. My remedy is composed of the following ingredients: 1. Take the bark of the root of the common hemlock, (Pinus Canadensis.) 2. The inner bark of white oak, (Quercus Alba.) 3. Common brake root, (Pteris Aquilina.) 4. The bark of green osier; all of equal quantities, and pounded finely in its green state, then mixed and put into an iron kettle, pour rain water on it till the powder is covered, then raise the temperature to 180° Fahrenheit, and keep it constantly near the said degree of heat for three days; after this, throw the mass into a filter bag and let the fluid run off; keep the fluid, and put the drained mass into the kettle, pour water on it as before, and repeat the process till the maceration is completed. The fluids so obtained are mixed together, and the mass of the powder thrown away as useless. The said fluid is put into the kettle, the heat again raised to 180° F., and kept so till it is evaporated to the thickness of syrup. In this state it is poured into tin pans, and exposed to the action of the sun, or the moderate warmth of an oven, and continued at such a degree of heat, till it attains the consistency of pitch, and it is then fit for use."

Claim.—"Having thus fully described my improved mode of treating ruptures, what I claim therein as my invention, and desire to secure by letters patent, is constructing an appilative composition, formed in the shape of a truss pad, substantially as herein set forth, and employed and operating in the manner described."

6. For a *Method of Lubricating Machinery with Water or other Liquids, as Substitutes for Oil;* P. S. Devlan, C. S. Wood, & John Hancock, of Chester and Philadelphia, Pennsylvania, August 8.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the combination of the reservoir, bucket wheel, box, and gudgeon, as described, for the purpose of using water, or any liquid, as a substitute for oil, on machinery, or, in the case of using oil, to save its consumption. This water, or liquid, can be also applied by means of a spiral wheel or Archimedean screw, or any shaped wheel, screw, or elevator, that will raise water or any other liquid, and discharge it upon the journal. We also claim the introduction of the air chambers in the bucket wheel."

7. For an *Improvement in the Striking Part of Clocks;* Thomas A. Davies, City of New York, August 12.

The patentee says,—"The nature of my invention consists in making a register, to be put upon the hour socket of a clock; also connecting this register with stops upon the striking wheel, by means of two arms, working upon a centre; also in placing new stops upon the strike wheel, and in a new combination of the striking part."

Claim.—"What I claim as new and original, and desire to secure by letters patent, is applying to the hour socket of a clock, a register, made as above described, for the purpose of counting off, as the hours go round, the stops upon the strike wheel, or the stops arranged upon the strike wheel shaft.

"I also claim the application of two arms from a centre shaft, essentially as above described, the end of one of which strikes upon a register, as above described, guiding the end of the other to stops upon the strike wheel, or to stops arranged upon the strike wheel shaft.

"I also claim the new mode of stopping the striking parts of a clock, by means of pins or stops arranged upon the strike wheel shaft, essentially as above described.

"I also claim the combination in a clock of the lifting part—the stops arranged as above described. The two arms form a centre for the objects above described, and the register, made and applied as above described—all together, or any two together."

8. For an *Improvement in the Manufacture of Stannate, or Stannite, of Soda or Potash, used in the dyeing and printing of fabrics;* John Greenwood, John Mercer, & John Barnes, Lancaster, England, August 12.

"Our invention has for its object the manufacturing stannate or stannite of soda, or potash, in a dry crystalline or pasty state. It is well known to dyers and printers that, in making tin-preparing liquor, or stannate of soda, it has been heretofore usual to take at the rate of one gallon of what is known in the trade as oxymuriate of tin, and adding thereto twelve, sixteen, twenty, or more gallons of dilute caustic soda, and this constitutes their tin-preparing liquor, or stannate of soda, or the stannate of potash, when potash is used in the place of soda.

"Now according to our invention, the stannate is made into a dry state, or in crystals, or in a pasty state, so as to pack into a small compass, and then the parties using it prepare therefrom the desired tin-preparing liquor, by dissolving the same in water.

"We take twenty-two pounds of caustic soda, (one gallon weighing thirteen and a half pounds,) and put it in an iron crucible, heated to a low red heat, by a fire under it. When evaporation has taken place, so as to produce (or nearly so) what is called hydrate of soda—that is, until watery vapors cease to be evolved—we then add eight pounds of nitrate of soda, and four pounds of common salt (chloride of sodium.) When the mixture is at or near the fluxing heat, we add ten pounds of feathered block tin. We stir the materials together with an iron stirrer, the mass becomes dark colored and pasty, and ammonia is given off. The tin decomposing both the water of the hydrated soda, and part of the nitrate of soda, the stirring is continued, as well as the heat under the crucible, until ignition or deflagration takes place, and it becomes red or white hot, and of a pasty consistence. This product is stannate of soda. We then take it out of the crucible, and when cold, grind it into powder, and it is dry stannate of soda, suitable to be packed and sent out to the printer and dyer. But if it is desired to have it in a more pure state, we merely dissolve the dry stannate of soda in water, and allow any impurity it may contain to settle.—We take the clear liquor, and evaporate down to crystallization in an iron boiler, and as the crystals form at the bottom of the pan, we take them out, and dry them on hot iron plates; or we evaporate all down to a pasty state, not quite dry, but so dry as not to let any fluid run from it. Should stannite be desired, instead of stannate, then we take four pounds of common salt, one gallon of caustic soda, weighing thirteen and a half pounds, one pound of nitrate of soda, and four pounds of feathered block tin. We put all these at once into a hot iron crucible, over a fire, and stir and boil to dryness, still stirring the dry powder so long as any ammonia is given off. We then consider the process finished. We now remove the contents from the crucible, and it is what we call stannite of soda, in a dry state, differing from stannate, inasmuch as the tin contains only half the quantity of oxygen. In order to obtain tin-preparing liquor, we take the stannate of soda, and dissolve it in boiling water, about three pounds to one gallon, and add three, four, or five gallons of cold water to it, to form the strength required for the different styles of work, according to the discretion of the printers. This solution of stannate of soda is to be used for, and in lieu of, what is known in the arts of printing cottons and de laines, as tin-preparing liquor, or stannate of soda liquor, and we apply the stannite in the same way, and as is well understood.

"If stannate or stannite of potash is desired, then potash will be employed in place of soda, and the chemist, from the directions above given for soda, will readily prepare the stannate or stannite of potash.

Claim.—"Having thus described the nature of our invention, and the best means we are acquainted with for performing the same, we do not confine ourselves to the means above described, so long as the stannate or stannite of soda, or of potash, be produced in a dry state, or in crystals, or in the state of paste, so as to pack in a small compass for ready and convenient transport. And we would wish it to be understood, that what we claim, is the manufacturing of the stannate and stannite of soda and potash, by fluxing nitrate of soda, and potash, and tin."

9. For an *Improvement in Hot Air Furnaces for Heating Buildings;* Joseph R. Morris, New Haven, Connecticut, August 12.

Claim.—"What I claim is the manner of arranging and combining the flues and air-heating pipes as herein fully described, viz.: the ends of the air pipe being connected with an end pipe, or conductor, communicating with the space between the double walls, so that the air shall be heated and the heat equalized before it enters the furnace chamber, whether such conductors be vertical or horizontal, or in any other position attaining the same purpose.

"I also claim arranging the flues and radiators, with respect to the fire chamber of the furnace, so that the air shall impinge upon the fire chamber in the manner described."

10. For *Improvements in the Self-acting Brake for Railroad Cars;* Edwin Hager, Chatham, New York, August 12.

We are under the necessity of omitting the claim in this instance, as it refers to, and could not be understood without, the drawings.

11. For an *Improvement in the Cooking Stove;* Bancroft Woodcock, Wheeling, Virginia, August 12.

Claim.—"Having thus fully described the nature of my improvements in the cooking stove, what I claim therein as new, and desire to secure by letters patent, is, first, the employment of a movable or shifting hearth, by which the fire chamber may be so divided as to cut off its lower part, and leave the upper part of such size as to adapt it to the burning of wood in an economical manner.

"I claim the manner of forming and using the boilers, with their guard-plates, substantially as set forth."

12. For *Improvements in the Hydrant;* F. H. Bartholomew, City of New York, August 12.

The patentee says,—"The object of my first improvement is to provide a means of stopping off the water which shall be self-acting, and therefore not liable to accident or negligence, and at the same time effectually avoid the bursting of the pipes by the water ram, and this I effect by closing the valve against the current or flow of the water by means of a spring or weight, the tension or gravity of which is greater than the force of the water, but which gradually overcomes it, and therefore avoids that sudden concussion which endangers the safety of the pipes, the valve thus closed having the effect of a safety valve to yield to any sudden pressure or concussion which might be too great for the pipes. And my second improvement consists in the peculiar manner of employing a stopper on the side of the valve stem for closing a small water aperture through which is discharged the water contained in the body of the hydrant, to prevent freezing in cold weather, but which may be turned on the stem to prevent the discharge of the water in warm weather."

Claim.—"What I claim, therefore, as my invention, and desire to secure by letters patent, is the method, substantially as herein described, of closing the valve of a hydrant or stop-cock, by a spring or its equivalent, against the flow or pressure of the water or other liquid, whereby I am enabled to prevent any injurious result from the water ram, as described. And I also claim making the waste hole of the hydrant oblique, in combination with the shifting stopper, substantially as herein described, whereby the flow of water is prevented, or nearly so, whilst the valve is opened and the water within the body of the hydrant retained or discharged, when the main valve is closed, as described."

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13. For *Improvements in Bridges;* Horace Childs, Henniker, New Hampshire, August 12.

The patentee says,—"In the construction of arch bridges, with diagonal braces between the under and upper arch pieces, the practice has heretofore been to abut the braces against the posts and arch-pieces at the junction of the two; so that the two braces, on opposite sides of each post, apply all the strain to the arch-piece at one point. This necessarily tends to break it at this point, and does not transfer the strain from one part of the arch to other parts—a result so important in a good bridge.

"The object of the first part of my invention is to arrange the diagonal braces between the lower and upper arch pieces, or arch-piece and its chord, and at a sufficient distance within the posts and vertical connecting rods, as to make that portion of the arch-piece perform the function of a lever; the post or connecting rod being the fulcrum, and thus to transfer the strain applied to any part of the arch from one diagonal brace to another, throughout the series, and in this way give to the arch-truss the greatest amount of stiffness due to the amount of timber employed.

"It is also well known that bridges are exposed to much lateral strain from wind, tending to force the arch trusses over out of plumb; and as an arch loses much of its strength when out of plumb, it has become a matter of great importance to perfect a bridge against such tendencies. The second part of my invention consists in making the middle arch truss of the bridge in two parts, inclined in opposite directions, connected together at top and separated at bottom, so that they resist the action of the wind in opposite directions."

Claim.—"What I claim, therefore, as my invention, and desire to secure by letters patent, is the employment of the additional nuts upon the suspension rods under the upper end, above the lower stringers, substantially as herein described, whereby the suspension rods answer the additional purpose of counter braces, as described. And I also claim the employment of the screw-bolts combined with the thrust-braces, and projecting beyond them sufficiently to pass through the stringers where they are united with the posts, substantially as described, whereby the brace-posts and stringers are bound together, as herein described."

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14. For an *Improvement in Truss Frames for Bridges, Roofs, &c.;* Frederick Hearback, Pittsfield, Massachusetts, August 12.

Claim.—"Although I have described the tubular beam, and claim the right to use such in a bridge, it will be evident that other arrangements or constructions of beams may be used; and therefore I do not confine myself strictly to the proportions of the various parts, as expressed in the drawings, nor to the material or materials, as above set forth; but intend to vary such as circumstances may require, while I maintain an analogous combination or combinations of them.

"I do not therefore claim as my invention the combination of diagonal thrust-braces and counter-braces (which act by thrusts,) and vertical suspension rods; but that which I do claim as my improvement thereon consists in a combination of devices by which the diagonal braces operate either by thrust or tension, at pleasure, while the vertical rods at the same time operate either by tension or thrust; the said combination by which this peculiarity is derived being composed of the attachments of the diagonal braces and counter-braces, and upper and lower stringers, together with the double sets of nuts upon the vertical rods, one set being above and the other being below each stringer; the whole being substantially as herein before specified."

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15. For an *Improvement in the Machine for Boring and Mortising Hubs, &c.;* James Munsell, Painted Post, Steuben County, New York, August 12.

The patentee says,—"My improvement consists principally in the manner in which I construct my feeding apparatus, by which the chisel is made to advance, whilst the article to be operated upon remains at rest, and, although I have applied it, and represent it as applied, to the hubs of wheels, this feeding part is applicable to mortising of all descriptions."

Claim.—"Having thus fully described the manner in which I construct my machine for the mortising of the hubs of wheels, and other articles, what I claim therein as new, and desire to secure by letters patent, is the manner in which I have constructed the feeding apparatus, and combined it with the sliding piece, so as to advance the chisel on the work, whilst the latter remains at rest, the feeding apparatus, consisting mainly of a lever, with its mortise, a feed lever and rack, and of a slot and feeding bolt, arranged and combined with the other parts substantially as herein described."

16. For *Improvements in Looms for weaving two or three ply carpets, and other figured fabrics;* E. B. Bigelow, Boston, Massachusetts, August 18.

The patentee says,—"The nature of my improvements in machinery for weaving two or three ply ingrain carpets consists, first, in the manner in which I construct and combine the cams for operating the lay, so as to give to it a vibratory intermittent motion. Second, in the manner in which I combine and operate four sets or series of shuttle boxes, said four sets or series being so arranged as to enable me to operate two of said sets or series only or the four together, as the fabric to be woven may require; the number of shuttle boxes in each set or series being varied at pleasure. Third, in the combination or organization of mechanism for raising and lowering certain of the aforesaid series of shuttle boxes, in the manner required to produce any given pattern or figure to be wrought. Fourth, in a certain combination or new organization of mechanism for operating the picker staffs or levers, by which the several shuttles are thrown in the order required. Fifth, in a certain peculiar mechanism or combination of parts, by which I am enabled to arrest the operation of the loom whenever the shuttle is thrown and does not properly enter the shuttle box intended to receive it. Sixth, in certain movable or turning guide plates applied to certain parts of the loom frame, in order to prevent accidents from occurring to the loom or a shuttle whenever the latter projects from a shuttle box."

Claim.—"Having thus explained the nature of my improvements in the aforesaid loom for weaving ingrain carpets, I shall claim therein the combination or organization of mechanism applied to each sword of the lay, for operating the lay in the manner as above described, and for the purpose of preventing the roller from wearing to such an extent as to improperly perform its office in the groove of its cam when the lay or reed thereof is required to be kept stationary during the throw of the shuttle; the said combination consisting of the groove cam (fixed upon the cam or key-shaft) the cam or passage (made through or upon the sword of the lay,) and the respective rollers, and the same being arranged and made to operate together substantially as hereinabove specified.

"I also claim the combination of four sets of shuttle-boxes and reciprocating pendulums or vibratory or moving frames, (by which they are sustained and moved from the front towards the rear of the loom, and *vice versa*,) as constructed, arranged, and operating together, and with respect to the lay of a loom and each other, substantially in any of the modes as hereinabove described, the same being for the purpose of weaving two or three ply plain or shot-about ingrain carpeting, or other fabrics, as set forth.

"I also claim, in combination with the shuttle binders of each series of shuttle boxes, and the hook of the ordinary stop motion of the loom, the mechanism or organization by which I am enabled, in the employment of the several series of vibrating shuttle-boxes, to arrest the operations of the loom whenever a shuttle is thrown and does not properly enter its intended shuttle-box; the said mechanism or organization of parts consisting of the cam, arms, and shaft from which they project the arm, with its projections, the arms and springs of either shaft, or other equivalents thereto, while the elements or members of the combination are made up of the above parts, and such additional parts as may be simply necessary to their operation, as above described.

"I also claim in its application to the plate, and the vibrating frame of shuttle-boxes immediately adjacent to it, a spring or movable guide plate, arranged and operating in the manner and for the purpose as above specified."

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17. For an *Improvement in the Manner of Accumulating Ice and Cooling Water;* John Dutton, Axton, Pennsylvania, August 18.

The patentee says,—"The nature of this invention consists in cooling water and accumulating ice, by compressing air to one-fifth its bulk, more or less, in any convenient manner, and causing it to suddenly expand to its original state, and come in contact with a body of water issuing from another vessel, and passing by the air outlet in such a manner that the water will be suddenly converted into ice, or a degree near it, on the general principle, that air, by suddenly expanding, generates cold, its capacity for heat being increased."

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is cooling and congealing water and other fluids by means of compressed air confined in the vessel, and conveyed through a tube provided with a cock, and surrounded by another tube provided with a cock, (and communicating with a reservoir of water,) and allowing it to suddenly expand, while surrounded with the water, in such a manner as to cool or congeal the water, on the principle that air, by suddenly expanding, absorbs heat, its capacity for heat being increased, as described."

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18. For an *Improvement in the Machine for Breaking and Dressing Flax and Hemp;* Smiley H. Sample, Fayette, Missouri, August 18.

The beaters are bars attached to three heads on a shaft, the middle one being of greater diameter than the two end ones, so that in their rotation the beaters generate two frustrums of cones. The middle head is cam-formed between the beaters or bars, and the concave is formed of two series of slats, each series being attached at one end, and the other ends resting against the cam-formed periphery of the middle head, so that as the beaters rotate the slats of the concave move in and out. The beaters are designated in the claim by the letters (f, f), the cam-formed periphery of the middle head, by the letters (i, i). A rest over which the hemp is fed, above the concave, by the letter E, and the elastic slats of the concave by the letters (h, h).

Claim.—"Having thus fully described the construction and operation of my improved hemp and flax breaking, scutching, and cleaning machine, what I claim therein as new, and desire to secure by letters patent, is the combination of the beaters (f, f,) and cam projections (i, i,) arranged as above described, with the rest E, and elastic rods (h, h,) substantially in the manner and for the purpose herein set forth."

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19. For an *Improvement in the Life Preserver and Trunk;* Edward G. Fitch, New Orleans, Louisiana, August 18.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of a life-preserver and traveling trunk, by constructing the same of two water-tight apartments connected by hinges and straps of such a size and shape that they will fit to the chest of a man, and leave free play for his arms, and may be secured to him by the straps, as herein set forth, when a buoyant life-preserver may be acquired, the water-tight apartments serving for receptacles for the money and most valuable parts of a traveler's wardrobe, and the central apartment, formed by the union of the water-tight apartments by straps and hinges, with the temporary bottom and cover, serving for a receptacle for a carpet-bag, and for the least valuable part of a traveler's baggage."

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20. For *Improvements in the Machine for Turning the Heads of Wood Screws;* Thomas W. Harvey, New York, August 18.

Claim.—"What I claim as new in the within described machine for turning the heads of wood screws is, first, the particular manner in which I arrange, combine, and operate the punch or driver, the tool-holder, and the rest, which are actuated by the double grooved cutter cam, so as to co-operate in the turning of the heads of the blanks, in virtue of the arrangement of the moving parts herein fully set forth. I also claim the particular manner, herein described, of constructing the adjustable turning head, the slide or seat piece, the tool-holder sliding on the piece, between the cheek pieces, with the respective adjustments thereof, combined, arranged, and operating so as to effect the setting of the tool, substantially as herein set forth; the manner of operating the griping dies, and of separating the blanks in the hopper, and conveying them to the feeding fingers, being similar to those described and used in the machine for cutting the threads. I do not herein claim in their individual capacity such parts thereof as I deem new, having been claimed by me in their combination with the threading machine: but I do claim them in their combination with the apparatus for turning the heads, as herein described and made known."

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21. For an *Improvement in the Brake for Railroad Cars;* William Clayton, Marshalton, Pennsylvania, August 18.

The patentee says,—"This brake consists of two horizontal parallel sliding bars arranged between the wheels below the frame made to slide alternately and transversely back and forth in corresponding openings in plates, fastened to the frame, or in suitable boxes, by a right angled connecting rod, connected by pins to the said bars, and operated or vibrated back and forth by means of a connecting rod and vibrating lever, working on a fulcrum attached to the frame, two rubbers being attached to each rod on the outside and inside of the edges so as to produce eight rubbing surfaces simultaneously against the inner and outer faces of the wheels, instead of the peripheries of the wheels as in the old plan—each bar working through the rubber of the corresponding bar on the inside of the wheel,—so that as the lever is moved towards the car, for the purpose of arresting its motion, the four rubbers will be caused to embrace or gripe the edges of the wheels, in the manner of a vise or pair of tongs."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is constructing the brake, in the manner described, to gripe the rims of the wheels, and apply the friction to the sides thereof, (instead of the peripheries,) or other modes substantially the same, by which analogous results are produced."

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22. For *Improvements in Barometers;* Peter Armand Lecomte de Fontaine Morean, City of London, England, August 20.

Claim.—"And having now described the several purposes in which my principle may be rendered useful, I repeat that I do not confine myself to the actual details herein described, but that I claim as my invention the application of flexible air-tight diaphragms of any material sufficiently elastic, and of any form which will produce the above results; that is to say, to measure the pressure of fluids, gases, &c., by the fluxions of the said diaphragms."

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23. For *Improvements in the Sofa Bedstead;* John Needham, City of New York, August 20.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is making the sofa seat cushion on a hinged frame provided with a mattrass below it, so that when this frame is thrown open the mattrass on this frame shall constitute a bed independent of the sofa cushion, as herein described; and this I claim in combination with the mattrass made in the permanent frame below, as herein described.

"I also claim making the sofa-cushion and one of the mattrasses on opposite sides of the same frame in combination with springs interposed and held in place between two webbings or cloths, substantially in the manner described, so that the same springs shall answer for the mattrass and sofa cushion, without affecting one of them when the other is in use, as herein described.

"I also claim the manner of connecting the legs with the hinged frame by means of the slot and pin in combination with the socket, substantially as described, so that when the legs are drawn out they can be folded into recesses or rebates in the frame, and when pushed they will be held, to prevent them from folding over as described.

"And, finally, I claim the hinged or jointed moulding in combination with the catchers attached to and moving with the hinged frame, subtantially as described, so as to liberate the moulding by the lifting of the cushion frame, as described."

24. For an *Improvement in the Wood Screw;* Thomas J. Sloan, City of New York, August 20.

The patentee says,—"Screws have heretofore been formed gradually tapering at the core from where the thread starts to the end, by dressing the thread at each turn, and tapering screws have also been formed, but they have been found not to hold so well as those of common construction, by reason of the taper of the main part of the core; but the nature of my improved screw consists in forming, on a screw of the ordinary shape, a conical point, and extending the thread of the screw with the same pitch, but gradually diminishing in width to the end of said point; by which means the screw can be entered into the wood without boring, unless the wood is very hard, in which case it follows better, works straight, and holds more firmly, than any other heretofore made."

Claim.—"What I claim as my invention and desire to secure by letters patent, is forming on a wood screw, of ordinary shape, a conical threaded point, substantially as herein described; the thread on said point being gradually diminished to the end, as set forth above."

25. For an *Improvement in the Scarificator for Surgical Operations;* George Tiemann, City of New York, August 20.

Claim.—"What I claim as new, and desire to secure by letters patent, is, first, the application of lancets set to cut diagonally, instead of direct; and, second, the combination with the lancet so set of the rod, spring, and trigger, arranged to act by the rack and pinions to give the required motion to the lancets; the whole constructed and operating substantially as described."

26. For *Improvements in the Carding Engine;* Charles Pooley, Chorlton upon Medlock, England, August 22.

Claim.—"Having now described the nature of the invention, and in what manner the same is to be performed, I declare that I claim as my invention, first, the afore-described arrangement of the clearers and workers above and below the main cylinder, in combination with the arrangement for feeding and doffing at one and the same side of the cylinder, or end of the machine—the whole being substantially as above specified; second, the construction of the top roller by the combination of a cover of leather or other substantially similar material, with the body made of meshes of cloth, or other substance having like properties effecting a like purpose, as described."

27. For *Improvements in Machinery for Weaving Fish Nets;* Peter Moulton, New Rochelle, New York, August 22.

This machine is necessarily complex, and as the claims refer to, and are wholly dependent on, the drawings, we are under the necessity of omitting them.

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28. For an *Improvement in the Revolving Horse Rake;* Hiram S. Doolittle, Kortright, New York, August 22.

The claims, which we are under the necessity of omitting, because of their reference to the drawings, are limited, first, to the use of a ring having studs, in combination with the axle, to the centre of which it is attached, and also with a spring having slots in it to receive the studs which hold the axle of the rake, so that when the spring is depressed by the foot, the rake rotates to discharge. And, second, in the use of supplementary teeth, called spiders, which are shorter than the rake teeth, and inserted in two rows between the rows of teeth, so that they shall strike the ground in the rotation of the rake and support it, and at the same time aid in turning it.

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29. For *Improvements in Boom Derricks;* Albert D. Bishop, Brooklyn, New York, August 22.

The patentee says,—"Instead of making the boom which sustains the weight that is being lifted, as heretofore, to project all on one side of a mast, which tends to carry over the whole apparatus, and which therefore has to be sustained by guy ropes, I make the boom to extend horizontally to an equal distance beyond a short mast that turns in appropriate bearings in the upper part of a frame standard—this rear projection of the boom being provided with a brace rod which is connected with the base of the standard by a roller or rollers and rail, to admit of the free turning of the boom. The rope by which the weight is sustained and raised, passes over a pulley that has its bearings in a block that slides on two rails on one end of the boom, and moved from or towards the mast by two cords attached to the sliding block, one of them passing directly to and over a pulley let into the mast and through a hole therein; and the other passing first over a pulley at the end of the boom and then over another pulley on the mast, so that by means of these two ropes, after the weight has been raised, it can be moved towards or from the mast; the lifting rope being passed also over a pulley attached to the mast and down through the hole therein. This arrangement will admit of turning the boom in any direction to deposite the weight at any point within a circle of which the boom is the radius. The standard is a triangular pyramidal frame, with a circular base provided with an inverted circular rail under which the roller of the brace rod runs, and with two sills to rest on, or by means of wheels to run on a permanent railway to admit of moving the whole apparatus to any distance required by the extent of the work intended to be done; and the upper end of this standard is adapted to the reception and turning of the mast of the boom. The mode of framing this standard is good, and highly important as affording more stiffness and solidity for various kinds of structures, than any other mode of framing with which I am acquainted. It consists of three posts placed at equal distances apart, and so inclined as to form a triangular pyramid, connected together by horizontal ties, and braced together by diagonal braces running in opposite directions and crossing each other; each set commences at the base of one post, runs up diagonally to the next, on one face of the pyramid, from the upper end of this brace another commences on the other face of the pyramid, and runs up at the same inclination to the next post, at the end of which and on the third face of the pyramid, another commences and runs up at the same angle to the first post to complete the circuit, and so on to the top; the other set runs up in the reverse direction, and crossing the first. In this way the system of diagonal braces commences at the base, on each face of the pyramid, extending up to the top, the ends of the braces where they come together, and on opposite sides of each post, overlap, so that one bolt passes through the ends of four braces and one post."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is making the boom to extend back of the mast, which turns in an elevated standard, in combination with the mode of bracing it by means of a brace-rod connected with the base of the standard by a roller and rail, to admit, at the same time, of turning the boom, as described.

"I also claim the mode of constructing the standard, by making it of three posts tied together to form an equilateral triangular pyramid, in combination with the system of diagonal braces, as herein described, whereby the structure is rendered stiff and unyielding, to resist vertical and oblique thrusts and all tendency to twist, as described."

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30. For *Improvements in the Wire Cable or Chain Suspension Bridge;* John A. Roebling, Pittsburgh, Pennsylvania, August 26.

The patentee says,—"My plan of anchorage differs very materially from the mode hitherto pursued. It is principally calculated for such locations where there is no rock and where an artificial anchorage has to be made. In most cases, the practice has been to resist the pressure of the anchor plates to which the chains or cables are attached, and which are continued below ground in a straight course,—directly by a large mass of solid masonry, constructed either in the form of arches or straight walls and butting against the abutments upon which the towers rest, which support the chains or cables. In this case, pressure is transmitted to a small surface of stone wall which has to to be constructed with great care and of the best of masonry. And as the base of this masonry is but small, its extent in length must be proportionally large so as to offer the necessary resistance.

In place of resting the anchor plate directly against a stone wall, I apply in any mode a system of timbers which serve in a manner as a foundation for the superincumbent masonry, distribute the great pressure of the anchor plates over a large surface of masonry, reduce therefore its length or depth, and by its yielding or elastic nature prevent the breaking of the anchor plates. I prefer curving the chain or cables below ground in place of continuing them straight. It is also my practice to surround all the iron below ground by hydraulic cement and wall it in with solid masonry, in place of leaving an open channel as is the case in most suspension bridges. The cement with which I surround the chains or cables preserves them against rusting effectually. Where greater precaution is desired the chains may be enclosed in lead.

Claim.—"What I claim as my original invention, and wish to secure by letters patent, is the application of a timber foundation in place of stone, in connexion with anchor plates to support the pressure of the anchor chains or cables against the anchor masonry of a suspension bridge, for the purpose of increasing the *base* of that masonry, to increase the surface exposed to pressure, and to substitute wood as an elastic material in place of stone for the bedding of the anchor plates. The timber foundation either to occupy an inclined position, where the anchor cables or chains are continued in a straight line below ground, or to be placed horizontally when the anchor cables are curved, as exhibited in the accompanying drawings, the whole to be in substance, and in its main features, constructed as fully described above, and exhibited in the drawing."

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31. For *Improvements in Cooking Stoves;* David G. Stafford, Syracuse, New York, August 26.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, the extension of the hot air chamber entirely around the central portion of the oven, for the purposes herein set forth, viz.: dividing the flue space leading from the fire chamber into two lateral parts, and separating the fire chamber from contact with the oven, for the more equally diffusing heat to every portion of the same, and the reducing and regulating the temperature of the oven by means of the valve, substantially as herein set forth."

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32. *Improvements in Machinery for beaming, breaking, and fleshing Hides;* Anthony Smith, Cumberland Valley, Pennsylvania, August 26.

The scraping knife which acts on the hide is jointed to a frame that slides on the end of a jointed beam by means of a crank motion, the beam being jointed simply to enable the attendant to regulate the pressure of the scraping knife on the hide, which is secured to the top of a table that receives a reciprocating motion to move the hide from end to end while the vibration of the sliding frame carries the knife or scraper across it.

Claim.—"Having thus fully described my improvement, what I claim therein as new, and desire to secure by letters patent, is the vibrating scraper, constructed, combined, and arranged substantially in the manner and for the purpose set forth, the pressure being regulated by the operative, while the scraper is driven by power. I also claim, in combination with the above, the movable table above described on which the hides are fastened, and are moved under the knife."

33. For *Improvements in the Ice Boat, or Machinery for cutting and removing Ice in Harbors;* Wm. Blount and John Cammett, Osterville, Massachusetts, August 26.

Claim—"We therefore claim as our improvement, adapted and to be applied exclusively to the removal of ice from harbors, &c., the combination of the gang or series of saws, the lateral discharging plough, and the series of revolving tooth cylinders, the whole being arranged and operating in concert, as above described.

"Also, the manner of combining the apparatus for cutting and removing the ice with the boat so as to enable the former to be adjusted to the ice to be cut; the same consisting in applying the discharging plough, with its cutters and toothed cylinders, to the boat by means of a fulcrum, or rocking shaft, stanchions, or posts, and other contrivances connected with the same, as set forth; the whole being combined, arranged, and operated together, so as to elevate or depress the nose of the plough, as hereinafter specified.

"Also, one or more lateral wings, or ploughs, or frames, or other mechanical equivalents, as combined with the full and main lateral discharging plough, and operating to discharge the ice from the frozen surface contiguous to the side or sides of the vessel, in the manner and for the object as hereinbefore explained."

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34. For *Improvements in the Manufacture of Wire Ropes;* Robert Sterling Newall, Gateshead, England, August 26—to run fourteen years from the 6th of March, 1843, the date of the English patent.

The patentee says—"The nature of my invention consists in manufacturing wire ropes in such a manner as to carry out the following two new principles, viz.: the preventing the wires being twisted in themselves, and the keeping them equidistant from the centre of the strand, and the strands equidistant from the centre of the rope. My invention also consists in a new method of inserting fresh wires or strands, when laying the wires into a strand or the strands into a rope."

Claim.—"Having now described a means of carrying my invention into effect, I wish it to be understood that I do not claim the machinery above described as my invention, although it was invented by me, because many other methods of arranging machinery for making wire ropes on the principle I have discovered may be invented. But I claim as my invention, and desire to secure by letters patent, first, forming each strand by winding wires spirally around a flexible core without twisting the wires, and forming the rope by the winding of such strands in the same manner around a similar core, the core of the strand being about equal in size to the wires, so that every wire in the spiral of each strand shall be laid equi-distant from the centre of such strand, and every strand equi-distant from the centre of the rope. Secondly, I claim a method of inserting a fresh wire or wires, or a fresh strand or strands, in laying the wires into the strand, or the strands into the rope, made as above, when six wires are used in making the strand, or six strands used in making the rope."

35. For an *Improvement in the Spark Arrester;* Samuel Swett, Jr., Boston, Massachusetts, August 26.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is placing a heart-shaped cap or bonnet, having solid edges and reticulated sides, inside the outer case, and over the upper part of the smoke pipe, in the manner and for the purpose set forth, or other mode substantially the same and for a like purpose"

The object of the heart-formed cap is to deflect the sparks, &c., and give them a downward tendency.

36. For *Improvements in the method of Propelling Vessels;* George W. Fulton, Brazoria, Texas, August 26.

The claim, which is omitted because of its entire dependence on the drawings, is limited to the combination of pipes, &c., for discharging jets of water at the stern of a vessel to produce the propelling action. Also, to an arrangement of parts for reversing the direction of the current. And also, to an arrangement of parts for regulating and stopping the issue of steam.

37. For an *Improvement in the Scarificator for surgical purposes;* Adolph F. Ahrens, Philadelphia, Pennsylvania, August 26.

The fleams are attached to and moved by a plate connected with the body of the instrument by what is known as the parallel links, such as are used in the well known parallel ruler, so that when the spring is liberated the points of each fleam describe a segment of a circle in giving its cut.

Claim.—"Having thus fully described my improvements, what I claim as my invention, and desire to secure by letters patent, is the combination of a series of fleams with a plate, constructed and moved substantially in the manner and for the purpose set forth."

38. For an *Improvement in the Horse Power for driving machinery;* Daniel Woodbury, Weathersfield, Vermont, August 26.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of gearing by means of cogs upon both sides of the main wheel, and two pinions upon one and the same inclined shaft, one at each end of the shaft: one of said pinions with the cogs on one side of the main wheel, and the other on the opposite side. This mode of gearing renders the machine much stronger, more easily worked, more durable, and less liable to injury by a sudden start of the horses, and is supported at less expense than any other mode yet discovered."

39. For an *Improvement in the Cooking Stove;* Loftus Wood, City of New York, August 26.

The patentee says—“ The oven is represented as having its bottom plate corrugated, but this is not claimed as a new feature, and my improvements are independent thereof; the first of these consists in the preventing of the burning out or warping of this plate at that part where it is immediately exposed to the direct action of the fire. In this part I form a recess in the plate which I fill with a plate of soap stone or fire clay, which can be readily removed at any time, and will save great cost and prevent much inconvenience in the continued use of the stove.

“ My second improvement consists in the particular arrangement of the part of the stove by which I introduce heated air into the room. This I do through tubular grate bars situated immediately back of the fire chamber, against which bars the fuel lies, and between which the heated air and gases pass into the flue under the oven. These tubes extend down through the bottom plate of the stove and terminate above in an air chamber from which the air that has been heated passes into the oven through holes made for that purpose in the fore plate thereof.”

Claim.—“ Having thus fully described the nature of my improvements in the cooking stove, and pointed out the manner in which the same operates, what I claim therein as new, and desire to secure by letters patent, is the particular manner in which I have arranged and combined the hollow grate bars, by causing them to ascend vertically at the rear and lower part of the fire chamber from the bottom plate of the stove, and to conduct air into the air chamber, whence it passes into the oven through openings in the fire plate thereof, for the purpose and in the manner herein set forth.”

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40. For an *Improvement in Cooking Ranges;* John L. Hayes, Boston, Massachusetts, August 28.

We are under the necessity of omitting the claims, as without the drawings to which they refer entirely, the character of the invention could not be understood.

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41. For an *Improvement in Machinery for Planing Blind Slats;* Arad Woodworth, 3rd., Worcester, Massachusetts, August 28.

Claim.—“ Having thus described an organized machine for planing blind slats in the directions of the grain of the wood, and upon both sides and both edges before they are discharged from it, that which I claim as my invention, is the combination of the two hoppers or receiving chambers, the planing or reducing irons to operate on two opposite sides or edges, or two opposite sides and two opposite edges of a board, and the carriages with their appendages or arms, by which the boards are moved from one hopper into the other, and out of the latter and in contact with the plane irons, as arranged and operating together, substantially in the manner as hereinbefore specified. I also claim the pistons or boards, as combined with their respective hoppers, and operating thereon in manner and for the purpose as described."

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42. For an *Improvement in Stoves for Heating Apartments;* Loftus Wood, City of New York, August 28.

Claim.—"Having thus fully described the manner in which I construct my improved stove for the heating of apartments, what I claim therein as new, and desire to secure by letters patent, is the manner of arranging and combining the revolving register, the air chamber, and the lateral gratings, for the admission of air to the fire, the air being admitted into the chamber or space through openings in an annular register above said air space, and the draught from the air space to feed the fire being supplied thereto through four or any other preferred number of lateral gratings, in the manner set forth.

"I also claim, in combination with the foregoing, the manner of admitting air from the ash-pit into the air space by means of the curved or other suitably formed air-conductors, leading from the ash pit into said space, and governed by the opening and closing of the ash-drawer.

"The air chamber surrounds the fire-pot—the upper end of this chamber is covered by a plate with holes in it governed by a register. The air that enters this chamber through the register at top, after being heated, passes into the fire through gratings in the sides of the fire-pot.

"The ash-pan at the bottom is provided with curved air passages which conduct air to the air chamber."

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43. For an *Improvement in Tailors' Shears;* Isaac Jaques, Elizabethtown, New Jersey, August 28.

Claim.—"Having thus fully described my improvement, what I claim therein as new, and desire to secure by letters patent, is constructing the shears with the lower blade formed narrow in its vertical section, and extending out laterally sufficiently to strengthen it; and elevating the bows so that the shears can be opened and closed without elevating the lower blade from the counter; the whole being constructed substantially in the manner and for the purpose set forth."

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44. For an *Improvement in the Machine for Dressing Mill Stones;* Charles Carlisle & Edwin Eastbrook, Norwich, Vermont, August 28.

This is an adjustable train to be adjusted to the spindle of a mill stone to determine the plane of the face of a mill stone in dressing it.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the combination of the frame, herein described, with the socket, adjusting shaft, and elevating screws, constructed and arranged substantially as above set forth."

45. For an *Improvement in the Cultivator;* William Dysert, Gettysburgh, Pennsylvania, August 28.

The teeth of this cultivator are attached to two bars, one in front and the other in rear, and each of these bars is made in two parts jointed in the middle and there connected with the beam, so that by means of these joints the bars can, on each side, be inclined to any desired angle with the line of the beam. When at right angles the teeth will be at their greatest distance apart, and by varying the angle they can be made gradually to approach the line of the beam. These jointed bars are held in any required position by bolts passing through slots in cross timbers.

Claim.—"Having thus fully described my improvements, what I claim therein as new, and desire to secure by letters patent, is the movable and jointed frame for cultivators, constructed and arranged substantially in the manner and for the purpose set forth.

"I also claim, in combination with the shovels for cultivators, the point, having a shank thereon, for the purposes above set forth."

46. For an *Improvement in Bridges;* William Howe, Springfield, Massachusetts, August 28.

This is for combining an arch with the counter braces of a truss frame, the counter braces being provided with nuts and screws to bear above and below the arch, and thus retain it in its proper relative position with reference to the truss.

Claim.—"Having thus fully described the nature of my improvements in the truss frames of bridges, what I claim therein as new, and desire to secure by letters patent, is, first, the manner in which I have combined the arch-beam with the counter-braces, and the other parts of the truss frame, by means of the regulating screws that are made to bear on the arch beam, or upon the bearing-blocks or wedge-pieces, so as to effect the same purpose. I also claim the manner of sustaining the bearing of the braces on the string pieces, by passing the metallic sockets entirely through the string pieces, so that the bearing blocks and the nuts, operate on the upper and lower ends of the sockets, and are not affected by the shrinkage of the wood work."

47. For an *Improvement in the Machine for Punching Copper;* A. H. Teeple, New York, August 28.

Claim.—"Having thus fully described the manner in which I construct my machine for punching metallic plates for sheathing, and shown the operation of the same, what I claim therein as new, and desire to secure by letters patent, is the manner in which I have combined and arranged the respective parts thereof, so as to adapt it to the purpose in view; that is to say, I claim the combining and arranging of the segment plates, with their punches and corresponding cavities, as described; said plates being geared together at their ends, and working upon suitable centres, the respective parts operating and being operated upon substantially as herein set forth. And I will here remark that double chains at each end, attached and arranged in a manner well known to machinists, may be substituted for the toothed gearing. The vibrating of the segments also may be effected by a crank motion, and other changes may be made in the particular manner of arranging some of the parts herein pointed out, without in any way departing from the general principle, or manner of construction, upon which the value of my machine is dependent; and I do not therefore intend by anything herein contained to limit myself in these particulars.

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48. For *Improvements in Machinery for Cutting Files;* Major H. Fisher, Assignor to Joseph A. Hyde, Bridgewater, Massachusetts, August 28.

The patentee says,—"In devising machinery for cutting files, a difficulty hitherto insurmountable has been experienced, which results from the variation in the hardness or density of the metal at different points of the 'blank' to be wrought upon; or to state the difficulty more practically and specifically, where the piece of metal or 'blank' is softer in some points than others, the chisel will cut deeper in such points, and as the feeding motion is regular, the chisel at its next descent will strike in the groove previously made, and merely widen said groove without forming another tooth. Serious difficulty has also been met with in accommodating the chisel edge to the 'wind' (so termed) of the 'blank' or the imperfection of its surface.

"These difficulties are avoided and surmounted by my improvements, my machine being so arranged as to imitate or perform automatically, as it were, the *manual* process which is now in vogue for cutting files, and which consists in placing the chisel edge in advance of a tooth which *has* been formed, and on the smooth part of the blank, and drawing it back until the operative feels the said tooth when the blow is immediately given with a heavy hammer which forms its succeeding tooth and its adjacent groove. In my machine this function is effected by so arranging the chisel, that for each groove and tooth its cutting edge is made to *reach out* and *slide back* in a manner substantially analogous to the manual process above specified, the movement of the chisel being produced by mechanism which will be explained in the sequel.

Claim.—"Having thus described my improved file-cutting machinery, I shall state my claim as follows: What I claim as my inventions, and desire to have secured to me by letters patent, are—

First. The springs and lip combined, (whether used with or without the auxiliary stud,) for actuating, guiding, and regulating the movements of the chisel as above described, and also any mechanical contrivances varying therefrom, but substantially the same, and combined substantially in the same manner for the same purpose.

Second. Gaining and retaining the gain upon the feed motion, substantially in the manner or upon the principles herein above set forth.

49. For an *Improvement in the Instrument called the Wife's Protector;* John B. Beers, Rochester, New York, August 28.

FRANKLIN INSTITUTE.

Address delivered at the close of the Seventeenth Exhibition of American Manufactures, held by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, October, 1847. *By* Joseph R. Chandler, Esq.

Ladies and Gentlemen:—When called by the Committee on Exhibitions of the Franklin Institute to assist in the ceremonies and services of this occasion, I felt disposed to decline the honor intended for me, from a deep conviction that, in a place where honors follow service, I should not, by any performance of the latter, achieve for myself any portion of the former.

There is, however, a service rendered to a great cause, by the willing co-operation of the humblest instrument; and for an institution that proposes the good of all, by the perfection of manufacturing and mechanic arts, there may be a service, at least by way of encouragement, when one of the number of those who can have no interest in its labors, excepting for the general benefits of its success, stands forward, and, in the name of the community, expresses the sense of deep and lasting obligation under which that community has been placed by the successful efforts of the Institute, to promote progress in mechanic arts, to apply science in aid of labor, and to multiply all the benefits of productive industry.

The community in which we live, the communities with which this institution has formed intimate connexions, by the beneficial effects of its proceedings on their pursuits, appreciate the importance of encouragement to the arts, and the constant proximity towards perfection consequent upon properly excited and well directed emulation. There is a general concurrence in the opinion, that the Franklin Institute has wrought great benefits to the country, by its influence upon productive labor. Perhaps, in some instances an indistinct, and in others an exaggerated, idea of the value of these results may obtain; but every where the great truth is admitted, and on all hands the obligation is felt and acknowledged.

The nature and extent of proceedings already had in this great festival, and the lateness of the hour, render it important that my portion of the exercises, to be acceptable, should be limited in time; and, unwilling to draw too liberally upon the patience of the audience, I shall, without further preface, inquire into some of the benefits produced by this society and these exhibitions; and incidentally, perhaps, while I show how infinitely beyond ordinary calculations are to be the good effects of the services of the Institute, and the frequent public exhibitions which it promotes and sustains, I may disturb a few of the less founded expectations or beliefs of advantages wrought, or to be wrought, by the society. An exaggerated expectation is as injurious as a deficient estimate of the importance of any public institution. The former exposes to mortifying and disheartening disappointments; the latter, though it retards encouraging efforts, is in the way of growing confidence, by the constant amount of success over calculation. In instituting these inquiries, I shall, in the first place, have reference to the Franklin Institute, rather than to this and the antecedent exhibitions, regarding these latter only as valuable results of the existence and labors of the former.

Of the origin and progress of the Franklin Institute I need not speak; the history is familiar to most of you here; its works are known throughout the scientific world; and the minds of the practical members of this institution have been brought into communication with those of kindred societies in Europe, thus giving an exchange of thoughts and discoveries profitable to society, and honorable to those engaged in the commerce of mind: a species of interchange in which, however we may differ in views of other commodities, we shall all, perhaps, profess ourselves friends and advocates of free trade.

Great and important to the public as are the advantages of such results, they are not, I confess, those which I would directly cite to prove the excellence of this institution over others; as many associations in this country may be engaged in this species of correspondence, without producing those ends which, in my opinion, constitute the boast of the Franklin Institute.

Whoever may have been engaged in the incipient stages of this society, or whoever may have come to the aid of this work, when the weakness of infancy demanded careful nurture, or when the struggle of its youth reflected credit upon its avowed founders, it is certain that for the first time the attention of the mechanics, the laboring artizans of this city, was awakened to a sense of their own importance by the promulgation of the plan for the establishment and extensive benefits of the institution. Members of the different crafts had indeed associated for purposes of individual advantages to provide means to support the sick and the wounded, and to minister generally to those whose contributions had gone to swell a fund to be applied to in emergencies. The Carpenters had long before formed a sort of sodality that was productive of much good in its way. The Bricklayers have a confraternity, and other crafts have undoubtedly their unions, to which the destitute and the unfortunate, who have assisted the funds, may look for aid to a prescribed amount. Excellent all these are to the extent which was contemplated in their establishment, but their founders never contemplate anything more than a sort of "beneficial society," and nothing beyond such an institution has resulted.

Each of these associations has been formed of members of one trade, so that dangerous personal rivalry in business was as likely to result among the successful members, as help and assistance to the unsuccessful.

There are instances, indeed, in which the mechanics of various branches have united; but it has usually been for some limited object, and has generally terminated in a political confederation that has been swallowed up by the two rival political divisions of the country.

But the prospectus of the Franklin Institute seemed to appeal to no branch of the mechanic arts, to offer a single inducement to one that was not equally operative in another. The least discerning of the artizans could see that, if the society carried out its views, his position in life as a tradesman would be elevated if he only reached hold of the means presented; and that, besides the general benefit resulting to the productive classes from such an institution, there were exhibited means by which particular distinction could be attained by superior mind and superior application. Hitherto he had felt that there was no such means of elevating himself and his pursuits. He had seen the lever and noticed the fulcrum by which others had been raised; but he could not discern where the power was to stand that was to raise *him* and his craftsmen from the level upon which they had been placed.

Men had indeed attained eminence who had pursued the calling of the artizan, but these fortunate ones had willingly given the influence of their elevated position to their new associates, few or none returned from the Halls of Legislation to the work bench. Almost all of them felt that they had broken away from servitude when they ceased to labor; and even those who were elevated, without pecuniary independence, seemed, when their official term had expired, rather disposed to seek employment in some minor office, than to bring back to the workshop the credit of ex-official dignity.

Labor, then, was a burthen—mechanic pursuits were inconsistent with Legislative action—the artizan felt that though he could eat and drink like others, and provide, with his own hands, for all his physical wants, there was a barrier between him and his fellow man. That barrier the Franklin Institute proposed to remove, and those who had found themselves in a degraded caste, saw that they were to be freed from disabilities—from impediments the more insurmountable as they were found in the condition of their calling. It was soon perceived that the plan was adapted to the exigencies of the case, and that the remedy was not the application of extraneous means, but the excitement of inherent, indwelling qualities, that needed only to be called into action to connect the existing position of their possessions with that condition which they had deemed inapproachable, or if approached, irreconcilable with a connexion with the past. Hitherto the inexperienced artizan had regarded the position which did not call for manual labor—which admitted of mental culture, and social refinement, as a haven upon which he might enter, only when he put off mortality and its cares; it was at least a condition so elevated as to be wholly independent of, and unconnected with, his pursuits. The Franklin Institute seemed, in his vision, to erect the ladder by which the light-hearted mechanic might ascend to enjoy the felicity of the upper state, and, what was more miraculous, by which he could descend to mingle his sympathies and his exertions with his fellows, whose ascensive powers were yet unimproved.

There was nothing, indeed, in the plan of organization that partook of the character of their existing societies, or that seemed to promise pecuniary aid in case of misfortune. But it was easy to perceive that the attempt to apply the principles of science to the every-day pursuits of life, was to dignify those pursuits by investing them with something of the importance which had been attached by themselves to the science, abstract and separate from its connexion with their trade.

But who were to bring about this great change? Certainly not they whose condition was to be improved by the alteration.

Men of science were to unite in the work; men whose education had given them the theory of all that the mechanic was exemplifying with his labor; these men were to bring their attainments to a common treasury, and the mechanic was to be invited to throw in his share in the partnership, and thus be invested, if not with the right of drawing pecuniary aid, still with the greater privilege of solacing his spirits, wounded by separate pursuits, and elevating his condition and his hopes by the use of the new ingredients in the means of success.

There was to be a *union;* not of hands employed alike, but of heads and hands, of mental and physical powers, so that labor should be lightened by a comprehension of the design, and genius made useful by the chastenings of practical knowledge.

We talk of the theory of equality, set forth in the great paper which declares the independence of this country, and also that mighty document which ascertains and defines the rights of men and the powers of government. But what a beautiful illustration of the theory of our institutions is found in a society that fuses into one mass, materials that had been deemed antagonistic, and removes from the most active and numerous portions of the people, the occasion of discontent!

Abroad, the discontent of one class must express itself quietly, or the established order of society will drive the malcontents back to their prescribed condition. Revolution is the only alternative. With us, discontent produces irritation, and public sentiment may be too weak for the ebullition likely to follow. The institutions of the country that leave open every avenue to distinction and wealth, are wholly unequal to the emergencies that may follow a sense of inequality in a particular and numerous class, unless a combination of circumstances tend to facilitate the ingress by these avenues. The right to rise, guaranteed by the constitution, may be productive of more vexation to those unable to exercise that right, than would be the canon of an arbitrary government, that shut out ambition by establishing castes.

The true policy of a people that proclaims equality of rights, is to labor towards an equality of condition. Of all the forms which war has assumed, that of civil contest is the worst, and civil war comes more frequently from the evidence of some legal right too largely enjoyed on one side, than from the sense of right denied to the other.

Servile war is made to assert and secure some unadmitted privilege. It is rare, because it is unsustained by any legal right; civil commotion starts upon an acknowledged right; but it is suggested by the presence of some inequality of enjoyment, the more difficult to be comprehended, from the established equality of rights. Whatever, therefore, tends to diminish the distance between the feelings, the pursuits, and enjoyments of classes of citizens, tends to promote general happiness of a positive kind, and to ensure peace and order. And the association of the limited class of theorists, with the extensive class of practical men, the union of the one head and *two* hands of society must diminish, must destroy the distance that has existed, and thus secure the object so dear to a republican government.

To this great end the Franklin Institute has ministered, and herein it has proved itself an immense political machine, leveling the inequalities of society, and preparing for that general co-operation of citizens which is the realization of all the practicable theories of Republicanism, the true development of the idea of man's being "born free and equal."

The single point at which I labor as a part of the theme of my discourse is so pregnant with suggestions, and so illustrative of the effects of republican principles, it admits of so many modes of explanation, and includes so much that relates to the social condition of our citizens, that it is in itself a proper subject for a volume, rather than a division of a short address. I must then content myself by merely presenting the subject, and leaving it for the future consideration of my auditors, all of whom have an interest either personal and direct, or by political and philanthropic sympathy for others, in the prevalence of the principles upon which the whole movement is founded, and the results of the operation of these principles as manifested in the success of the Franklin Institute.

Who of us all does not feel a pride in the consideration that the majority of those who, in the theory of this government, are the rulers, are daily exhibiting evidences of improved condition, of elevated views, of enlarged ideas of usefulness, and of extensive permanent happiness, founded on an increased rational self-respect?

The charitable institutions which characterize our city, evince the enlarged philanthropy of those among whom we live. But if it is good, laudable, meritorious, to help the miserable, give food and raiment to the suffering, how infinitely superior in all goodness is the scheme which prevents the necessity for eleemosynary aid, which keeps the foot from falling and strengthens the man in a sort of self-possession and self-dependence—that, while it connects him anew and more intimately with society upon which he may lean, prevents any feeling of obligation, by enabling him to supply his full share to the general compact, and to make him an equal partner by capital, by labor, and by profits in the great association of life

Let me not be mistaken in the hints which I have given. I do not consider that the condition of the working classes is improved by any diminution of ordinary labor. I do not count exemption from toil as any blessing.

I would not have the human form brutified by excess of labor, enforced by the tyranny of man or the tyranny of grinding necessity, but I would have all men labor in their vocation. Labor is not only the condition of health, the condition of life, but it is, in this country—nay, I may say in this age—the condition of respectability. I think all will agree with me, that human rights were never, in any former period, better understood or more respected than at present—and never since the existence of established political institutions have such a proportion of the human family been called to willing labor. Never was there a time when the idle man was so utterly insignificant in the eyes of others; never has he felt so intensely his own uselessness. Some, indeed, acknowledge the necessity of action; they have commenced here and there to show a sympathy with the growing spirit of movement which characterises the age; it is true that no general or particular benefit has resulted from their activity; they have rather been in the way of others; like Diogenes rolling his tub through the streets of Athens, they have rather served to indicate the general tendency of the public mind, than to promote the object of popular movement.

I have referred to the operations of the Franklin Institute, and the effect of its labors, as promotive of republican habits, and illustrative of the effect of republican principles. In this regard the Society is entitled to the gratitude of every citizen of this extended nation. I may, however, remark, that the Institute, in this respect, is promoting a family good, for I regard the Society itself as a child of our republican institutions. The fair legitimate offspring of those principles which include equality of rights and promote equality of enjoyment. And it is derogating nothing from the Society to give it this paternity. To deny to it self existence, is not to deny it the merit of doing good. No man is less entitled to our admiration for evident enlarged philanthropy "and all good grace to grace a gentleman," because deep down in his heart may be the well springs of religion that influence his motion and sanctify his action.

But some may deny to Republicanism the paternity of such institutions, and appeal to the existence of similar societies in monarchial governments. It is not necessary, in order to meet that objection, that I should institute an inquiry whether the associations of a cognate character have the same relation with the working classes that has the Franklin Institute. I doubt whether they have now, though they will have ere long. I omit such an inquiry because I assert that these associations, wherever formed, are the fruits of republican principles working in and purifying the whole social and political system—having utterance in various ways, but always of the same sentiment: manifesting itself in diverse types, but always from the same motive. Here where there are found no hereditary or established customs inconsistent with general equality, the movements for public good are plain and obvious, and soon productive. Abroad, they are not less manifest, but less distinct. They are discernible beneath the surface, but the form of the object partakes more or less of the incrustation above, and time and effort will be necessary for the entire development of the plan. The revolution is going on, impatience might produce convulsions. Let us, while we give them the benefit of our example, hope that the cause will not be injured by impolitic haste.

I have hastily referred to the origin, motives, principles, and effects of the Franklin Institute, with no view of instructing my hearers on these points, but rather to keep alive the feelings in which all the good has been done, and to present anew the connexion of this institution with the principles of our government, the comforts of our people, and the requirements of our religion.

But the particular occasion on which we have assembled amid all the affluence of the production of art and science that are around us, the great holiday of the Society, and of those who are interested directly in this display—the occasion is one which suggests a reference to the *means* by which the Franklin Institute labors to promote its ends. How she awakens the pride of the laborer to new exertions without complaint. How she teaches him that "the labor we delight in physics pain." How she stimulates the liberality of the capitalist without diminishing his means.

We who have examined the various ingredients of this marvellous exhibition, now near its close, have been struck not only with the excellence of the productions displayed, but especially with the evidences of improvement in the various fabrics and productions of the loom, the crucible, the mill, or the implements of art.

Every article seems to approach perfection—every object seems as if it took all credit from the past, and ordinarily the feeling has been that we have outstripped all of other times in the texture, quality, and beauty of our productions. I doubt whether the claim to excellence will be generally allowed. It is a common error of the people of this country to judge of the state of arts generally by what they see around them, and to imagine that the improvement made in the fabrics in this country, within the present century, is the exact measure by which to judge of the progress of other nations. This is a great error. Many of the manufactures of the ancients exceeded in beauty those around us. In the product of the loom, not much has been gained in delicacy of texture, nor has the needle augmented the elegance of embroidery. The luxurious tastes of the ancients, and their command of men and means, seemed to ensure for their use a high degree of perfection in the manufacture of whatever was known to them. Silk, for example, though rare, was yet produced in astonishing delicacy of texture.

Holy scripture abounds in statements of the rich productions of the loom, chiefly, indeed, of fine linen, which, among the Hebrews, as among the Egyptians, was probably for a long time used only for the sacred garments of the priesthood. Very early we find that bonnets were made of fine *twined* linen, and even (to use the language of Scripture) the *breeches* of the priests were, by special authority made of linen; and as this material did not, at that time, enter into the manufacture of articles for ladies' dresses, we may fairly infer that, at *that* time, also, the particular garment fabricated therefrom was not allowed to the women, even to the wife of a priest.

At a later day, this seemed to be remedied, and Solomon, enumerating the virtues of a good wife, mentions in particular her manufacture of articles of fine linen—really the manufacture, for "she seeketh wool and flax, and worketh willingly with her *hands*." Nay, not only did she *make* all these articles, but she sold them to the merchants. In the present day, the opulent manufacturer contents himself with allowing females to work with their hands in the factory, but he does not make his wife the factor—why, I do not know, unless he should fear that her superior tact in business should deprive him of titular superiority. The Scriptures are full of references to the fine fabrics of linen and wool; how fine, we do not exactly know; but from the frequent and emphatic reference to *that* quality, we may suppose that a very delicate texture was produced for the service of the temple, and subsequently for the rich and luxurious laity.

Forster, a writer of great research, asserts that silk was in good use in Arabia within five hundred years of the flood. I should suppose, however, that its use became less general in later times, as Mahomet takes particular pains to dress up his luxurious female saints, the Houris of paradise, entirely in silk—a kind of wardrobe which would not have been selected, had garments of that article been common to the faithful. These, however, denote only the material—the character and positive delicacy are not mentioned. But the Roman poets are more particular. They speak of the wonderful tenuity of the web and woof, and mention the silken dress as so exceedingly fine as to give coarseness to the wearer, so *delicate* as to create a sense of indelicacy. Horace, who is not very particular in his language when he means to satirize the vicious, speaks of a silken vest that reveals rather than conceals the person.

Caligula fringed his throne with silk, and wore a silken robe; or, perhaps, rather a robe made in part of that material. Lucan, in describing the dress of Cleopatra, says:

> Her snowy breast shines through Sidonian threads
> First by the comb of distant Seres struck,
> Divided then by Egypt's skilful toil,
> And with embroidery transparent made.

My female auditors will readily perceive, notwithstanding the use of the word embroidery, that the Queen of Egypt wore a silk lace kerchief,

> Thin gauzy cloud before a blazing sun.

Almost all the writers in the Greek and Latin language, of the Augustan age, enrich their descriptions of dresses, with accounts of silk vestments, so that we may fairly infer that at that period the ornamental portions of dresses were as rich and gorgeous as any that are now made.

Cotton fabrics were manufactured by the ancients, of exceedingly delicate texture, and indeed of all textures, from the coarse canvass used to form the sails of ships, to the most delicate portions of a lady's dress.

The very name of the sails of a ship *cabase*, was that of Cotton, as we now poetically speak of the *canvass*, instead of the sails, of a vessel. A poet of the earliest Christian time, says:

> A muslin 'kerchief by a knot compressed,
> Passed o'er her shoulders and adorned her breast."

And we know, from good authorities, that our neighbors the Mexicans (who, by the way, stand not in a very neighborly relation with us at present) were wont to make dresses of the most delicate texture of cotton, interwoven with the finest rabbit's hair, and present them, or sell them to the nobility for waistcoats. And if there is a lady present who will, with me, venture to confess a recollection of affairs nearly half a century back, I might recall to her mind the delicate *mull mulls* which seemed to have been woven in rivalry of the gossamer web, that then was and is now, for there is no improvement in that branch of manufactures, floating in an October atmosphere.

The disclosures in Pompeii make manifest, also, that the cabinet-maker and the smith of various kinds were very expert in periods anterior to the Christian era, and that pride and opulence might command whatever taste and ingenuity could devise. There was no deficiency in mechanical skill, where there was taste to require and means to compensate. Arts, indeed, have been lost in the sand-drifts of time, and the researches of the wise and the learned have been enabled to find only the vestiges that denote the flight of the pursued.

Much of all that you see around you in these halls denoting the wonderful progress of the manufacturing and mechanic arts in this country, are little else than imitations of the products of the ancients; with occasional improvements in the quality and form, though the latter is often a professed, or rather boasted imitation of the shape that distinguished particular periods and geographical divisions in elder times. Whatever was majestic in size or delicate in form and texture, seemed to have been of other times, as well as of the present; and we occasionally bring to light some wonderful product of industry and art, unearth a pyramid, or unroll a parchment, which tells of greatness of efforts and successful exertions standing in gigantic conception as much before those of the present times, as do the remains of the Megalosaurus, of the second or middle period, before the Alligators of the mountain streams of Pennsylvania.

Nor in other matters did the past lack the means to invite us to imitation. Homer describes carpets of exceeding beauty, and every poet seems to have before him some pattern of extraordinary workmanship by which he enriched his verse, and added to the charms of his mistress. The ingenuity of the Egyptians early wove the delicate fibre of the flax into winding clothes for their dead; and when these had lost their sanctity by the death of their embalmers, further ingenuity was manifested in working the preserved mummy cloths into paper for the convenience of the poet and the conveyancer.

To what end, then, has the Franklin Institute labored? Only to restore lost arts? Only to force back, by slow degrees, this boasted and boasting age, to approximate the level of the past? Only to ornament the neck or arm of beauty with the delicate kerchief which Cos and Seres once supplied, or the gorgeous bracelet that the Queen of Egypt once exhibited? Have the water-powers of our country been purchased up, and the dyeing woods and insects of the southern region been employed only to manufacture and color fabrics that might vie with the vestments of the priests of Isis, or the garments of the worshippers of Cyprus? Are the vellum manufacturers of Pergamus to be the inimitable pattern-makers for the Ameses, the Wilcoxes, of our days? And the exhibition here before us, because it presents little that is more elegant than Persia, India, China, Egypt, and Rome produced, is it only the humble imitation of some ancient Bazaar, or of the store house of the manufacturers of antiquity?

To this point should public attention be directed. The Franklin Institute is a creation of the times, and while it regards itself as a great moving power, self-sustaining, self-moving, and of substantive existence, it is in fact only an instrument, a tool, adapted to the workmanship of the present age, and used by the great genius of the *times* to work out the object it has conceived.

I learn that politics are considered as among the prohibited subjects in your annual addresses, but I must depart from the rule, if any such is imposed. The prohibition, if it exists, is unnatural and unjust.—Your institution is in part political, all our relations are more or less of that character. I see nothing in our society anywhere that is not stamped with the initial or ear marks of enlarged politics; and that is as it should be. In vain do you establish a republican form of government, unless you create and keep alive social republican institutions; whatever may be the social relations of man, they soon mount up and influence his political condition. The government of a country can have very little effect upon the character and relation of the people, while all the minor institutions are constantly contributing to influence the government, and this is the more so in proportion to the republican character of the government. Those, then, who in this country are diffusing education, multiplying the means of ameliorating the condition of the many, transfusing into the lower classes, (while they are the lower classes,) the feelings, perception, and *wants* of refinement, are ministering to the diffusion and maintenance of true republicanism —not only in the perceptions, judgment, and wishes of the people, but in the character and influences of the government; because in a truly republican government, the ruling power must be constantly renewed by an unimpeded circulation, from all the extremities. That power must be central, undoubtedly, and *efficient*, but its centralization is only for the convenience of the constantly changing ingredients—and its efficiency is nothing but the general consent and co-operation of all the parts of the radii and circumference.

I stop not here to show how all our colleges, academies, and public schools—how all the philanthropic moral and religious associations of our country, tend towards the perfection of republican institutions, and the strength and permanency of republican government. Such a theme, however, is worthy the thoughts and consideration of all. But I refer directly to the exhibition of American manufactures that are around us, that rich display of articles that owe much of their excellence to the encouragement of this institution, which has, by creating emulation, established a high standard of work. This exhibition is one of the signs of the times; one of the tokens of the advancement of the great political revolution of the age; one of the means too by which that revolution is to be completed.

All the magnificence of the elder ages to which we have referred—all the rich and almost inimitable products of antiquity of which these are but the distant semblance, for whom and for what were they? The silk, that their religion consecrated, and their poets celebrated, was set apart for the gaudy trappings of political tyranny or religious deception, or it was the meretricious ornament of vice; nay, the medium for the display of indecency. The ornaments of gold and silver, the array of purple and fine linen—what were these but the exclusive enjoyments and properties of the favored few—consistent with the character of a government that considered the people slaves—slaves to labor for the wearer of purple, or at best slaves to vote for those who condescended to put on the deceptive *candida?*

Our national institutions have suggested and the Franklin Institute has carried out the idea, that whatever is good, is the more so in proportion to its extent; and while it has suggested beauty, taste, and delicacy in the formation and texture of the multiplied products of American ingenuity, its great boast has been that it has made all these the common property of the people, accessible to all of industrious habits; thus, by delicacy and appropriate beauty, refining the taste and polishing the manners of their humble possessors.

Why, the female domestic who assists in the culinary affairs of your household, shares as directly in all these blessings as does she who directs and compensates her labors. The household servant of our times—she who would have been the common property, the chattel for use and abuse, among the ancients—she wears dresses for show and for comfort that the nobility of Greece and Rome might have envied. The silk has descended from the altar and the throne of antiquity, to the kitchen of modern days, and the holiday dress of your chamber maid, for show and comfort, would excite the envy of the mistress of Pericles and of Athens. It is true—for though Aspasia had her purple to set off the lustrous white of her exposed bust, and delicate linen to relieve the brilliancy of her carmined cheek, and Lydia sent her costly stuffs, and Tyre ministered of her gorgeous dyes, and Egypt supplied her linen, and Syria her silks—yet neither Aspasia with all her power, nor the better but less distinguished matrons of Athens, enjoyed the unrevealed luxury of Lowell muslins.

I need not press the point nor multiply illustrations. It is obvious that any movement which tends to augment comforts and make them accessible to all, is a public benefit, and whatever tends to elevate the taste, refine the manners, and enlarge the social enjoyment of the multitude, is eminently favorable to republicanism.

Let me not be told of Spartan simplicity in food and raiment and habits. Starving and freezing may make courageous soldiers, and poverty may destroy in woman maternal affection; but in my mind short commons are always connected with occasional cribbings, and the boy who is half starved upon black broth, will not think it a crime to steal his neighbor's property, provided he can do it without detection.

The simplicity of republicanism has nothing to do with the vulgarity of ignorance and poverty—it refers to, and consists in, the absence of all complication of social distinctions and political rights; the establishment of that beautiful platform upon which the poor and the rich may meet together in the common enjoyment of all the benefits of government; that kind of equality which soon removes other distinctions, and without convulsions works out a general level for all desirable ends.

Some, I know, assert that multiplying the means of dress and cheapening the materials to the property of all classes, are productive of vanity that leads to vexation of spirit. I think not. On the contrary the only mode that I can see, of destroying the occasional vanity resulting from superiority of dress, is to make all kinds of dresses so cheap that the desirable distinction shall be in the simplicity of form. Depend upon it, infinitely more good is wrought by the elevating influences of good clothing, handsome, ornamental, than there is evil by a little excess. The cheering sun which warms the suddenly sprung weed into a gaudy flower, is necessary to the perfection of your life-sustaining corn;—so the influence of dress that makes the fool a fop, softens the character, modifies the manners, and elevates the feelings of one capable of improvement.

The benefits of the Franklin Institute are evident this evening, not more in the political influences, to which I have referred, and the multiplication and diffusion of the products of ingenious industry, for the melioration of all conditions, than in the appearances and character of the assembly attracted by the beauty and the usefulness of the congregated wonders of these halls.

No plan or principle that tends to the general improvement of man's condition is unworthy of woman's special attention; her own particular condition is identified with every meliorating effort. No new powers of good are to be conferred, but every successful attempt to improve society, confers on her new means of doing good; though there should be no enlargement in the sphere of her duty—yet there is a double efficacy in the efforts which she makes in her appropriate sphere. The work which she now does, the maternal instruction she imparts, the lessons of wisdom she gives to her children, are permanently and widely useful: they result from fixed principles and are in accordance with prevailing ideas of public good; to-morrow, with her and her lessons, shall be as this day, and much more abundant; while in other times her home-lessons, founded on no established code, were changeable, exposed to constant variation—like the web of Penelope, the morning saw unravelled what the evening had supposed complete.

Undoubtedly the circumstances of woman are greatly improved by advancements in the arts of life, and in proportion to the prevalence of these improvements will be the advantage which woman will derive therefrom. I do not know that she is to be freed entirely from many of the evils to which her sex has always been exposed in its relations with man. In the time of Solomon, the best of women, (because the best of wives,) was represented as toiling with her household while her husband was sitting in *the gates*. And in the present times it is to be feared that too many wives are bound down to drudgery, inconsistent with the delicacy of their frames, while their husbands are sitting, if not in the gates of the city, at least within the doors of the tavern, seeking praise and pleasure from services wholly incompatible with their social and domestic duties.

But improvement in the condition of woman certainly follows the prevalence of the means of desirable comforts. The mind acquires a delicacy from the multiplication and general use of articles that at one time were deemed the special property of the wealthy. And the taste and judgment manifested in the manufacture of certain articles become extended by the use of the article manufactured. The first effect of these delicacies upon the unameliorated mind, is pride of display; the ultimate result is a chastened sentiment of delicate propriety —in woman first—and most extensively operative through her—in man later, but effective and permanent.

Most appropriate then is the presence of Woman at this exhibition; she comes to encourage, by her appearance, efforts for domestic, social, and political advantage. She comes to show for whom the delicate and the beautiful of the products of the loom have been prepared: the delicate for the delicate—for whom the odors of Araby have been distilled and diffused: "sweets to the sweet."

Her presence, while it encourages and rewards the services which bless society, is an acknowledgment of her sense of the new importance with which all these advancements in the arts have endowed her sex.

The home that is made more delightful by the multiplication of domestic comforts, is more attractive to him in whose presence woman should delight. The freedom which a refined mind enjoys from former prescribed toil, may be beautifully employed in augmenting and strengthening domestic and social affections; and meet it is, that those who are to profit by these changes should smile upon the means by which these changes are produced. Most meet it is that woman should come hither to cheer the efforts by which her domestic, her social, and her religious condition is improved; that she should bless the improvement that enables every Martha to sit, like Mary, without household cares in the hour of instruction; that gives to every Cornelia the leisure to educate and train her Gracchi; that supplies to all her sex the box of precious ointment with which religious devotion is to be manifested and the heart's deep piety expressed.

I confess to you, Mr. President, and ladies and gentlemen, that in the plan of this discourse, the stage at which I have now arrived, was but the entrance to the subject. I am admonished, however, by the time already expended, that my duty is to leave the theme to another hand for another occasion, assured that it will never be too late to connect public good with republican principles: nor will the Franklin Institute ever fail to supply proofs, that by ministering to the former she is sustaining the latter.

I have hinted only at one means by which the Institute is doing good: she works by numerous modes, but all to the same end; extending her powers of usefulness by lectures, and her fame, and our city's honor, by her correspondence. But it is chiefly in the direct bearing of her existence and labors upon our republican institutions that I have sought to have her distinguished at the present time. On this subject we can all agree. On measures of government, there must always be such a difference, as to separate classes of citizens into distinct parties. But I love to think that the ends of all are the same, and to find, as I do here, that there are measures of general bearing on which the good and the great of every party may unite; that there is an institution in the country which, while it ensures the hearty and direct co-operation of all classes within its immediate influences, brings to its labors and its enjoyments the full consent and free-will offerings of people from every section of the vast Union, thus affording another link indissoluble and infrangible, to that chain of accidents, qualities, and institutions which,

> "Like a garland of flowers,
> Entwines all our States in a band,
> Confirms and confederates our wide spreading powers,
> Our wealth and our wisdom expands."

MECHANICS, PHYSICS, AND CHEMISTRY.

On the Cause of Evaporation, Rain, Hailstorms, and the Winds of Temperate Regions. By G. A. Rowell.

Mr. Rowell stated his opinion that amongst the variety of theories given in our Encyclopedias and scientific works there is not one that will *fairly* explain *all* the phenomena of evaporation; or if these phenomena are considered as fairly explained, the explanation of the cause of the suspension of clouds, rain, and every other phenomenon connected therewith requires the aid of some further hypothesis. The theory of Dr. Hutton on rain may be thought sufficient to account for moderate rains, but totally fails when applied to such heavy rain as that which fell in London, August 1st, last year, and therefore cannot with propriety be adopted in any case. Mr. Rowell endeavored to show that the phenomena of evaporation, clouds, rain, lightning, hail, the winds of temperate regions, and storms of lower latitudes, may be fairly explained by the hypothesis he submitted: *i. e.* electricity having no weight and diffusing itself equally over the surface of bodies, the minute particles of water, even in their most condensed state being completely enveloped in their natural coating of electricity, occupy, together with their electricity, nearly the space of an equal weight of air, and are thus rendered sufficiently buoyant to be carried away by the wind; but that when expanded by heat their specific gravity being then reduced, and their capacity for electricity being increased by the increase of surface, they are then buoyed up into the air by their electrical coatings; that when the rising particle is condensed it becomes surcharged by the contraction of its surface: if this takes place near the surface of the earth, the surcharge escapes and the particle falls as dew; but if it is condensed when above the electrical attraction of the earth, it is still buoyed up by the electricity, and on the escape of the surcharge, the particles attract each other and form clouds and rain.—Hills and mountains cause clouds and rain by conducting the electricity from the vapor, and not by condensing it; and on these grounds he again suggests, as a test of the theory, the experiment he proposed to the British Association in 1840: *i. e.* "To cause rain by raising electrical conductors to the clouds by the aid of balloons." In support of the proposition he read an extract from a letter he received from Mr. W. H. Weeks, of Sandwich, dated December, 27th, 1842, in which that gentleman assures him that "It has several times happened that when his electrical kite has been raised immediately under a distended, light, fleecy cloud at a moderate elevation, and a *free current of sparks* has passed from the apparatus for some ten or twelve minutes, he has suddenly found himself bedewed with a descent of fine misty rain, and on looking up has seen the cloud upon which he was operating surprisingly reduced in magnitude." Electrical kites cannot reach the clouds, and can only be raised in windy weather, when the clouds must be every instant passing away from the influence of such apparatus; and if they have such effects, what may we not anticipate from the use of conductors which would reach the clouds, and could be raised in calm weather? Mr. Rowell considered that from the reduction of temperature at the height of the clouds, the vapor in those regions must be always condensed, but invisible from being so diffused; and that the formation of clouds is not owing to condensation, but to the escape of electricity allowing the particles of vapor to attract each other. In support of these views, and also to show that the ascent and support of vapor at great heights must depend on some agent which is independent of heat or cold, he exhibited the table following:—

Heights.	Temperature of Air.	Water heavier than Air.
Level of the Sea	+60°	860 times.
1 mile	+43	1,083 "
2 miles	+26	1,363 "
3 miles	+ 9	1,716 "
4 miles	— 8	2,160 "
5 miles	—25	2,719 "

Another cause of rain is the pressure of particles of the vapor upon each other; for if a cloud be of great depth, say the lower part one mile high and the upper part two miles, as the electricity of the particles would be equal, those in the upper part would not have sufficient for their support, and would therefore press downwards, and those in the lower part would have more than enough to support them at that height, and would therefore press upwards, and thus press the particles in the middle of such cloud into contact and form rain, while the electricity being pressed out of the cloud, would accumulate on the surface till it could force its way to the earth or other clouds, and thus cause lightning. Violent hailstorms he attributed to the sudden equalization of the electricity of large masses of vapor floating at different heights in the air, and brought by currents and various circumstances the one over the other. The difference between the lowest mass and the top of the upper mass of clouds may amount to two or three miles. The violence of storms in such cases depends upon the density of the clouds and the height of their upper strata: as, the greater the height at which the hailstones begin to form, the greater will be the degree of cold they will acquire, and consequently the more powerfully they will act in freezing the vapor with which they come in contact during their fall; the greater also they will become by the accumulation of vapor in falling; and the greater will be the velocity with which they will arrive at the earth. The lightning accompanying such storms may be caused by the lower clouds forming conductors for the electricity from the highly-charged upper clouds to the earth. The diminution of the pressure of the atmosphere previous to and during rain, he ascribed to the escape of electricity from the invisible vapor or clouds; thus causing a vacuum or rarefaction in the regions of the clouds: and the air from its elasticity rising to fill the space, decreases the pressure on the mercury. Allowing that the trade winds, land and sea breezes, &c., are caused by changes of temperature, yet he contended that the more irregular winds are owing in a much greater degree to the fall of rain and the escape of electricity from the cloud, than to any change of temperature; for as each particle of water to be buoyant must, together with its electrical coating, occupy the space of an equal weight of air, as water is 860 times heavier than air at the level of the sea, every particle of water that falls to the earth must have occupied 860 times more space when suspended in the air; therefore, if in a given time one inch of rain falls to the earth, it must, during that time, have caused a vacuum or rarefaction in the space above to the extent of 860 inches: the vacuum would in fact be greater than this, for vapor to be buoyant must occupy a greater space according to its elevation; but as the density of the air decreases according to the elevation, the effect must be the same: *i. e.*, for every inch of rain that falls the vacuum would be equal to the gradual abstraction of the whole of the air to upwards of 70 feet in height over the whole district where the rain falls; which rarefaction must be filled up during the time the rain is falling by a rush of air from the surrounding districts, although such wind may not always be felt in the same locality in which the rain falls. He supports his views by referring to the storms of wind which swept over England from the northwest and west last autumn, at which time France and other parts of the continent were deluged with rain. He exhibited the following table of heavy rains (mentioned by Prof. Forbes in his Report on Meteorology in 1840) to show that they are sufficient to account for violent storms; and had no doubt that if we had accurate accounts of the *extraordinary* rains which sometimes fall within the tropics, they would be found sufficient to account for the most tremendous hurricane:—

Place.	Date.	Depth of Rain in inches.	Time.	Average vacuum per square mile, per *second*, in cubic feet.
Catskill, U. S.	July 26th, 1819	18 inches	7½ hours	1,331,968 cub. ft.
Genoa,	Oct. 25th, 1832	30	24	693,733
Joyeuse,	Oct. 9th, 1827	31	22	782,027
Geneva,	May 20th, 1827	6	3	1,109 973
Gibraltar,	Nov. 27th, 1826	33	26	704,406
Naples,	Nov. 22nd, 1826	$\frac{9}{10}$	37 minutes	809,980
Perth,	Aug. 3rd, 1829	$\frac{4}{5}$	30	838,978

—*Proceedings of the Brit. Assoc.* Athenæum.

On the Cause of the Aurora, and the Declination of the Needle.

By G. A. Rowell.

As the trade winds are caused by the flowing of the denser air from the polar regions to the tropics, the superior trade winds in the higher regions of the air must be from the tropical to the coldest parts of the earth, to keep up the equilibrium of the air; then, as it is proved by Forchhammer that more vapor arises from tropical seas than falls there, and that more falls in polar regions than rises in those parts; and, as it is proved by the experiments of Volta and others, that whenever evaporation takes place, positive electricity is carried off—it follows that there are electrical currents similar to the currents of air; the vapor, with its electricity, rising in the tropics (thus rendering those parts negatively charged) is carried thence by the *superior* trade winds to the colder parts of the earth, where the vapor falls; and its electricity escaping to the earth, renders those parts positively charged, whence the electricity rushes off along the earth's surface towards the more negative parts of the earth, and is again carried off by the rising vapor. Mr. Rowell ascribes the direction of the needle to these currents of electricity from the positive to the negative parts of the earth, and the aurora to the interruption of these currents of electricity, by the dry and non-conducting state of the air in the *frigid regions* during *severe frosts* insulating the electricity of the clouds, where it accumulates till it flashes back through the higher and rarer air towards the more temperate regions, thus exhibiting the aurora, and at the same time causing a disturbance of the magnetic needle. The author thinks that many writers have fallen into error in supposing the height of the aurora to be far above the limits of our atmosphere: which error may have arisen from some mistake in their observations, or from some other luminous meteor being mistaken for the aurora; for as the observations of Parry, Franklin, Richardson, and others distinctly prove that the aurora does take place near the surface of the earth, and is in some way connected with the formation of clouds, the arches which are sometimes seen at such great altitudes may arise from totally different causes. He considers that the diurnal variation of the needle tells in favor of the opinion that the direction of the needle is dependent on evaporation; as very early in the morning, when to the eastward of our meridian, evaporation must be at a minimum, the declination is least: the declination then *increases* till about the time when the evaporation must be most rapid, and then decreases till, in the evening, it reaches its medium position; and the fact that the diurnal variation is more than double in summer what it is in winter, tells in favor of this view. The cause of magnetic poles in this hemisphere he ascribes to the quantities of ice blocked up both in winter and summer in the high latitudes above the two continents, thus causing those parts to be the coldest in this hemisphere, and therefore the magnetic poles; for, as the density of the air from the frigid regions is the cause of the trade winds, and as the density of the air increases with the degree of cold, it follows that more air must flow from the coldest parts of the earth towards the warmer regions than from any other parts, and, consequently, there must be the greatest flow of the *superior currents* of air from the warmer to those colder parts, thus bringing more vapor and electricity there than to any other parts in this hemisphere. Now, if the greatest degree of cold be at the pole of the earth, and evaporation increased regularly thence to the equator, there would then be no declination of the needle, as the electricity would pass off from the coldest or positive parts towards the more negative parts of the earth in the direct lines of longitude; but as the magnetic poles are at a distance from the terrestrial pole, and as those parts are more positively charged with electricity than other parts in the same latitude, the electricity must diverge eastward and westward of the direct lines of longitude in passing off to the more negative parts of the earth, and thus cause the declination of the needle. The author contends that the fact that the aurora did not affect the needle at Port Bowen in 73° north latitude, whilst it had great effect at Fort Franklin in 65° north, tells in favor of his views that the direction of the needle is owing to currents of electricity from the magnetic pole to the more negative parts of the earth, as the American magnetic pole is in 70° north. Mr. Rowell exhibited a large diagram of the earth from the north pole to 40° north latitude, showing at one view the situation of the American magnetic pole according to Sir James Ross, and the Siberian pole according to Hansteen, the lines of equal intensity from Col. Sabine's maps, the lines of equal temperature from Humboldt, the direction of the needle shown by arrows, &c. By the diagram he showed that, in the meridian of the American pole, the lines of equal temperature descend to a much lower latitude than in any part of this hemisphere, which he ascribed to the polar seas there being land-locked and causing a great accumulation of ice in those regions both winter and summer, whilst the magnetic force, also, is greatest in that meridian. In the meridian of the Siberian pole, the Polar Sea is far more open, the temperature is higher, and the magnetic intensity less. In the neighborhood of Behring's Straits, where the Polar sea is open to the Pacific Ocean, the intensity is still less; but in the meridian of London, or rather to the east of it, the line of equal temperature rises to a much higher latitude than in any other part of this hemisphere, the intensity of magnetism is the least, and the Polar Sea is there open from Greenland to Nova Zembla, and the ice formed in those regions is liable at all times to be broken up and dispersed by the storms of the Atlantic Ocean. He considers the magnetic poles not to be mere points in the earth, but extensive districts in the coldest parts, and that even mountains, which, from their elevation, are continually conducting electricity from the higher regions of the air, must have some local effect upon the needle. He contends that the opinion is erroneous which ascribes the changes of declination to a rotation of the magnetic poles round the pole of the earth; as we have no proof that the magnetic poles in this hemisphere were ever situated otherwise than in the high latitudes above the two continents; and that the change of declination may be fairly explained on the supposition that the American pole has *increased* in strength, or the Siberian pole has *decreased* in strength, and that the line of no variation where the influence of the two poles are equal, has receded during the last two centuries from some point west of England to its present position eastward of St. Petersburg, thus bringing parts which formerly had an eastward variation to be under the influence of the American pole. He suggests that any geological change which has made the Siberian Polar Sea more open, would tend to weaken that magnetic pole; or any change which may have blocked up the American Polar Sea, would increase the strength of that pole. He concludes by again suggesting the experiment of raising electrical conductors, to the height of the clouds in the frigid regions during severe frosts, which he believes would cause the aurora, and also throw some light on terrestrial magnetism. Ibid.

On Lord Rosse's Telescope.

Continued from Page 281.

Unfortunately the whole month of February was of the worst astronomical character; and though the great speculum had only the imperfect polish already noted, it was kept in the tube as long as there were any hopes of seeing the great nebula of Orion. That, however, was always clouded while within its range. A few clear minutes on the 13th allowed them to see some stars and clusters; but the only circumstances worth mentioning were, that it shewed the stars of Castor far apart *without an eye-glass*,* and that the stars of the cluster 67 Messier, which Sir J. Herschel describes as being from the eleventh to the twelfth magnitude, were many of them as bright as those of the first appear in a three and a-half feet achromatic.

At length, when all hopes of Orion were lost in the twilight, the mirror was removed from the telescope, and polished on March 3d. Its frame is supported in the cubic chamber of the tube by three strong screws which give the adjustment of its optic axis. By unscrewing these, when the tube is vertical, four wheels with which the frame is furnished come to bear on a railroad fixed at the bottom of the chamber and communicating over a bridge (laid from its door when necessary) with another railway laid on an inclined plane of about sixty feet. It is drawn up this by the declination of windlass, and at its top runs on a strong truck by means of which it is drawn a quarter of a mile, on a common road, to the laboratory.

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* Only twenty-two inches of the mirror could act in this case.

The polishing machine differs in nothing but size from that described by Lord Rosse in the Philosophical Transactions. It makes the speculum revolve once for twenty-four and a-half strokes, and the eccentric once for eighteen. From seven to eight strokes of twenty-four inches are made in the minute, and the lateral movement of the speculum by the eccentric is fourteen inches.* A screw whose nut runs on a railroad above the machine lifts the speculum, with its frame and levers, from the truck, and deposits it on the revolving platform, where it is levelled, centred, and secured. The same apparatus serves to move the polisher during its preparation and to apply it to the speculum, so that it is even more manageable than that of the three-feet was. It was cast with the transverse grooves; the circular were cut in the lathe. The time required for polishing is about six hours; and Lord Rosse has found that this period cannot be exceeded without injury to the figure, in consequence of the soft pitch being squeezed out, and the harder and unyielding material coming into contact with the iron of the polisher: unfortunately, this occurred to some extent in the present instance. The ammoniacal solution of soap used towards the close of the process, happened to be made with ammonia prepared from gas liquor and containing some substance which acted on the mirror, and produced a dullness that was not removed till after three hours' additional work. Lord Rosse warned them that the figure must be imperfect, and wished to repolish; but they overruled this proposal, and it was replaced in the tube next day.

On examining it by diaphragm and disks, it was found that, as he anticipated, the edge was not quite perfect. All its zones showed ξ Ursæ Majoris very well with 560; but the exterior six inches manifested, when the star was thrown out of focus, that, though of the same focal length, this portion was irregular. Few other double stars were observed, as most of the lucid interval from the 4th to the 13th of March was devoted to nebulæ, and after that it again became cloudy: but enough were seen to satisfy them that the instrument possessed a very high defining power. This, indeed, was evident from the admirable exhibition of Regulus, seen on March 5th, neat and round, without appendages or flare. Gamma Leonis, ξ Virginis, 2 Comæ, and Gamma Virginis, were also well shown with powers of 400 to 800 on an unfavorable night; and the companions of ν Ursæ, and 245 of Struve's second Catalogue, which appear in the Slough and Pulkova telescopes as of the eleventh and tenth magnitudes, seem in this large stars.

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* These are the proportions which Lord Rosse prefers; but it must be kept in mind that they change with circumstances. *Probably* they will not answer for those specula which have an aperture larger than one-ninth of their focal length, and *certainly* not for those which are perforated in the middle. Dr. Robinson has made many experiments on one of the latter, fifteen inches aperture and nine feet focus, with a machine nearly the same as Lord Rosse's; and he finds that the nature of the polishing depends on the figure given in grinding. If the eccentric be regulated so as to make this hyperbolic, its action must be lessened in polishing so as to shorten the focus. In this way it is possible to obtain very good results. He, however, prefers the opposite course pointed out by Lord Rosse; grinding to an elliptic figure, he polishes with a very long primary stroke, and small action of the eccentric. A speculum thus polished shows ε Arietis well separated and defined with 940, and with 465 the fifth star in the trapezium of Orion's nebula is visible even when the acting surface is reduced to seventy-two circular inches.

Of planetary bodies, none were visible except D'Arrest's Comet and the Moon. The former, when viewed March 10th, presented nothing remarkable: the brighter portion, towards the centre, showed no abrupt change of light which might indicate a solid nucleus; there was no resolvable appearance in the Coma, and the very minute stars with which that part of the sky was dotted, were visible almost to its very centre. Only one view of the moon was obtained, March 20th, and it was shared with them by several visitors, who, when once in possession of the telescope, were by no means disposed to make way for the astronomers. The fascination of the sight is, indeed, such, that one can scarcely withdraw the eye: Dr. Robinson, therefore, and his friend, had but little time for observation. He was, however, much interested by the vicinity of the craters named Hansteen and Mairan, in the map of Beer and Mædler, where, besides the crowd of hills described by them, there are an infinity of others not visible even in the three-feet, but looking in this with 560, like grains of sand. Are these fragments ejected from the crater? If so, and if they occur round others, it would explain what had always presented to him a great difficulty. The lunar craters differ widely from those of earth; and most in this, that their depression below the general surface is enormously greater than the elevation of their walls above it, while the area of the hollow is far greater than that of the latter. What, then, became of the materials which had once filled it? He had formerly supposed that they were in a fluid or gaseous state when ejected; but the fact just mentioned seems to give the true solution, and appears to account for them when combined with the consideration of the feeble gravity on the moon, which would permit the exploded fragments to be scattered over a far larger space than with us. Another beautiful object was the river-like valley that runs northward from the crater Herodotus: its raised banks, and their irregularities, were easily seen; the internal and external shadows could have been satisfactorily measured had a micrometer been applied. As it was, the much greater breadth of the former showed at a glance that this strange channel was sunk deep below the lunar surface. Taking as a standard the measures given there by Beer and Mædler, he had no doubt that they then saw *without difficulty* spaces of eighty or ninety yards. It is difficult to say *à priori* what should be the minimum visible at the moon in such a telescope. If we assume, as one extreme, the statement of Amici, that the non-coincidence of two black lines on paper can be seen at twenty-eight feet, when it amounts to one-twelfth of an inch, or subtends 51″, then 311 feet should be visible at the moon with 1000. On the other hand, Jurin states (Smith's Optics) that a piece of silver wire can be seen on white paper, when it subtends 3″, a result depending on the intensity of this metallic reflection. This would give eighteen feet! Dr. Robinson finds that he can see the spider lines of his circle without much contrast of light, when they subtend to him 16″. This gives ninety-seven feet; but it must be remembered that aperture influences visibility as well as magnifying power, though we cannot, as yet, estimate its effect numerically.

The most important part of their observations were made on nebulæ; and, besides establishing completely the prodigious superiority of this instrument over all yet constructed, they have added some facts to our knowledge of these mysterious objects. A list of them was formed from the invaluable catalogue of Sir John Herschel, (Phil. Trans. 1833,) comprising such as, from brightness or any other peculiarity, seemed deserving of notice; of which forty were examined by Dr. Robinson and also by Sir James South, except some which the latter lost while making the transit observations required for the meridian line.* They may be separated into three classes; those which are round and of nearly uniform brightness;† those which are round, but appear to have one or more nuclei;‡ and those which are extended in one direction, sometimes so much as to become long stripes or rays.§ Of the first class, all that are examined are easily resolved, even with a triple eye-piece of wide field and power 360, used for finding the objects. In 854 the stars were seen through haze; in 1929 during twilight; and 1833 was noted as "consisting of rather coarse stars, and resembling Messier 13." Any increase of brightness towards the centre seemed to proceed from the greater depth of stars there rather than from any notable difference of their magnitude. But the second class presents much more interesting phenomena: the appearances which previous observers had described as *sudden condensation. nuclei*, or even single or multiple *central stars*, proving to be clusters of comparatively bright stars, surrounded by much larger collections of minute ones. A very beautiful example of this is 1456, fig. 41, M. 94, described in the catalogue as "very suddenly much brighter, almost up to a nipple-shaped nucleus:" it proved, however, to be "a vast circular cluster of stars, with ragged filaments, in which, and apparently central, is a globular group of much larger stars, power 400." The same system of arrangement (which seems very common) occurs also in 706, 748, 805, and many others: it is also found in the magnificent clusters 1663, M. 3; 1558, M. 53; and 1916, M. 5. In these, the splendor of which is not to be described, besides the stars visible in other instruments (which here seem of the first or second magnitude), the whole field is crowded with others much smaller, to such a degree that, had the first been absent, these would still have been noted as remarkable objects. The interior group is not, however, always central or symmetrical, but has knots of greater condensation, which sometimes (as in 1385) are alone visible in smaller telescopes, and then look like "twin nebulæ;" at others, (as in 739.) like stars. In 1622, fig. 25, M. 51, which is so well known from a sort of resemblance to Saturn, and from the more exact analogy which, as Sir John Herschel has well remarked, it bears to the Milky Way, we have another different development of this arrangement. Here, also, the central nebula is a globe of large stars; as indeed had been previously discovered with the three feet telescope: but it is also seen with 560 that the exterior stars, instead of being uniformly distributed, as in the preceding instances, are condensed into a ring, although many are also spread over its interior. Were the centre absent, we should have a ring nebula;* and were the line of vision near the plane of this ring it would become one of those rays with a bright nucleus and parallel band or satellite nebulæ which occur so frequently in the catalogue. In comparing it with our own sidereal system, Dr. R. thinks we should consider the stars visible to the naked eye, and the larger telescopic classes as constituting the central cluster, while the Milky Way represents the exterior and minuter stars either disposed in an irregular ring, or in a stratum, two of whose dimensions are much greater than the third. We have no reason for believing that the comparative brightness of stars depends *only* on their distances; 61 Cygni is not more remote than α Lyræ; much less can we assume that our stars are uniformly distributed: Orion, the Pleiades, Prœsepe, the clusters in Perseus, M. 36 and 37, with many others, are evidently mere knots of condensation in our immediate neighborhood, our peculiar cluster; and it seems a mere arbitrary assumption to fancy that, were we transported to a remote part of the milky way, we should see anything similar to our present sky.

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* Sir James South published an interesting and instructive notice of this telescope in the Times, April 16, 1845.

† Nos. 538. 739, 777, 844, 845, 854, 1797, 1833, 1907, 1929.

‡ Nos. 564, 706, 711, 743, 748, 749, 805, 843, 846, 1146, 1385, 1456, 1622, 1881.

§ Nos. 536, 604, 668, 791, 792, 810, 859, 1066, 1132, 1148, 1352, 1357, 1368, 1466, 1926. The numbers and the figures cited in the text are those of Sir John Herschel's catalogue.

The nebulæ of the third class which were examined seemed to differ from this type only by being seen obliquely, and therefore projected into ellipses sometimes almost linear. In this last case they proved much more difficult of resolution, probably from greater *optical* condensation, and yielded most easily towards their minor axes. In these the nucleus of brighter stars is sometimes extended like the exterior portion, as in 602, which is of considerable length and easily resolved: the central part has three knots, of which two are represented in fig. 70, all the rest having been invisible. 668 is similar, but the central part is of more uniform character. In general, however, the nucleus is globular, and remarkable from the comparative smallness of its diameter, and its very condensed appearance. Either the stars which compose it are few in number, or more closely compacted than is usual. 1132, M. 98, is a good example: "the long ray is resolved, except at the very extremities, with 560; the globular nucleus is seen with 1280 to consist of very close stars." 1148, described as "a nucleus with two branches, a star north following," appeared to Dr. R. as "an irregular ring of stars round a brighter group, but having an appendage like that of M. 51, in which is the bright star seen by H." 1357, fig. 37, is a similar object, both "the ray and appendage being full of stars, but the nucleus requires a higher power to resolve it than the night will bear." In 1466, fig. 84, *the nucleus projects on each side of the ray*, so that its diameter must be greater than the thickness of the exterior stratum.

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* It is possible that the exterior part of M. 94 may be merely a circular *disk* of stars: the absence of the central globe would make this a planetary nebula: but it is possible that these differ from the annular only in degree; all the latter which he has seen having faint nebulosity within them.

He could not leave this part of his subject without calling attention to the fact that no REAL nebula seemed to exist among so many of these objects chosen without any bias: all appeared to be clusters of stars, and every additional one which shall be resolved will be an additional argument against the existence of any such. There must always be a very great number of clusters, which from mere distance will be irresolvable in any instrument; and if it prove to be the case that *all* the brighter nebulæ yield to this telescope, it appears unphilosophical not to make universal Sir J. Herschel's proposition, that "a nebula, at least in the generality of cases, is nothing more than a cluster of discrete stars."

These observations will suffice to show how much may be hoped from this telescope; but they are far from being a fair measure of its powers, being made at very low temperatures. Almost always the thermometer was at 22°, or 20°, when they ceased working; and on one occasion it was as low as 17°, the lowest he remembered in Ireland. In such circumstances it is notorious that even small reflectors act very imperfectly: and he was therefore unprepared for any tolerable action of this gigantic speculum. In the day time it was, of course, colder than the air, and, if uncovered before that had sunk to its temperature, was covered with dew: when this went off it always defined sharply. The huge mass of metal cooled much more slowly than the atmosphere; and as the difference increased, the performance of the telescope was deteriorated. This arose from no change of figure, as he satisfied himself by throwing the stars out of focus; it was probably the result of currents in the tube occasioned by this difference of temperature. How far it will be possible to obviate this by mechanical means, remains to be tried; but it is certain that the inconvenience does not increase in a higher ratio than the power of the telescope, as he had formerly apprehended. On the same nights, it defined quite as well as the three-feet with a far lower power; and therefore, it is reasonable to expect that it can be used with advantage much more frequently than he once supposed.

Enormous as is its illuminating power, it might be increased one-third, by using it with the front view, supposing it can be properly figured for this oblique action. Without that, he fears that in an instrument where the aperture is so large compared with the focal length, the definition would be imperfect. He verified this by an experiment with the three-feet, and found that though the light was increased quite as much as he expected, yet the perfection of the image was utterly destroyed for large stars. There was no exact focus, but merely two places where the sections of the cone of rays were smallest. One, the least exceptionable, shewed a flare in the direction of the slope like a comet's tail: at the other this disappeared, but the star became a sort of curved rectangle with rays from its corners. In the Newtonian form this speculum, a few nights before, had defined ζ Orionis very well with 500; but now γ Leonis could not be seen double with any power; the companion of Rigel (some way from the meridian however) was lost in the flare, and even that of Polaris, though perfectly visible, was sadly disfigured by it. It was, of course, useless to try more difficult tests, as even this degree of imperfection would make it utterly incapable of resolving such objects as the nuclei of the long nebulæ, be its illuminating power what it may. One thing, however, deserves notice, that in consequence of removing the second reflection, the colors of the stars come out with extraordinary splendor.* β Cygni, for instance, had a pureness and brilliancy of yellow, in the large star, which was new to him, though he had seen it in many first-rate telescopes. Lord Rosse does not apprehend any insurmountable difficulty in applying his method to give the form necessary for aplanatic oblique reflection: more than one plan for this has occurred to him; and Dr. R. believes it is his purpose, as soon as the six-feet has its machinery completed, to try them on one of the three-feet specula, and, if successful, to alter the great one.

As it is, Dr. R. congratulates the Academy and their country on the success of this matchless instrument; to which, as nothing at all approaching to its power has yet existed, so it is not probable that there will soon be any superior. It has been reported that the French Government, at the suggestion of M. Arago, are about to construct an achromatic of a metre aperture. Supposing homogeneous disks of glass can be obtained and wrought of that magnitude, there remain other difficulties. The optician who proposed to supply them stated that they would weigh at least 400 pounds; now these, when mounted, must be supported by at most two lateral bearings; and it is known that a very moderate pressure produces in glass a double refraction, most injurious to its performance in an object glass. But supposing this and the equally probable change of curvature from the weight of the lenses obviated, still such an achromatic would be far below the six-feet in quantity of light. From Amici's experiment with an object glass of two and a half inches it follows that it equals a Newtonian when their acting surfaces are as six to ten: this would imply in the great one an aperture of fifty-six inches, and a focal length of eighty feet. But the absorption certainly increases with the thickness of the medium, though neither the law of this, nor the loss by the reflections at the four surfaces, are accurately known. Mr. Potter found that a good object glass, by Dollond, of four inches aperture and six feet focus, transmitted but 0·66 of the incident rays. This gives the ratio of the equivalent surfaces 0·74, and it will be still greater where the glass is three or four inches thick. It is said that the construction of a reflector still larger than this is contemplated by a northern Sovereign, who has already shown himself a most munificent patron of Astronomy. If so, none will rejoice more than Lord Rosse himself. It was not the mean desire of possessing what no other possessed, or seeing what no other had seen, that induced him to bestow so many precious years on this pursuit: had such been his motives, he would have kept to himself his methods, instead of opening his workshops, without reserve, to all who had the slightest desire of following his steps, and communicating in the most liberal manner the fruits of long and painful experience. His sole object is to extend the domain of astronomical knowledge: and the more common such instruments become, the more perfectly will it be fulfilled.

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* The lenses of achromatics have often a tinge of green or straw color, which modify the color of objects seen through them. Something of this may, perhaps, cause the predominance of green and "cinereus" which exists in the Dorpat catalogue.

On the Manufacture of Gas.

The great and growing importance of the adoption of the most economical and perfect methods of distilling coal for the production of carburetted hydrogen for artificial illumination, induces us to give the following general view of a paper on that subject, read at the Western Literary and Scientific Institution, Leicester-square, although but a few months since we gave, at considerable length, the very able lectures delivered by Mr. T. A. Hedley, at the Devonport Mechanics' Institution.

In 1739 appeared the first account of attempts to distil coals in close vessels, or retorts, and collect the products of gas in bladders for experiments: and which experiments were frequently made and continued up to 1792, a period of upwards of 50 years, during which time, although the practicability of easily procuring a cheap and beautiful artificial light by the distillation of coals had been so repeatedly manifested, still the tardy nature of men's minds, and the total absence of disposition for improvement, prevented any steps being taken for the introduction of so valuable a discovery.

In 1792, Mr. Murdoch, a talented engineer of the time, residing at Redruth, in Cornwall, where he was employed in introducing the then newly invented steam engine of the celebrated James Watt, for draining the deep mines of that county, constructed an experimental coal-gas apparatus, and lighted his dwelling. After this he removed to Soho, near Birmingham, to the steam engine factory of Bolton and Watt, where he lighted their manufactory, and other places. The plan adopted at this period was of the most primitive kind, being merely a close cast-iron vessel fixed in a furnace, in which, on its being partially filled with coal, and made red hot, the gas was generated, and conveyed away in pipes, in its crude and impure state, to the burners. In the introduction of such a valuable discovery, this state of things could not long remain; the shopkeepers soon discovered the injurious effects of sulphuretted hydrogen on their goods, whilst the air of rooms became so contaminated by sulphur and carbonic acid, as to be extremely unwholesome, and depressing to animal life. Lime was found to be a complete, convenient, and cheap material to remedy the evil, for the discovery of which there are several claimants. It was at first mixed with the water contained in the tank of the gas holder; the gas being delivered by a pipe a little below the surface, it rose in bubbles through the lime-water, and as a stronger affinity exists between the impure gases and lime than for carburetted hydrogen, this gas only was set free, and escaped above the water ready for use. This plan was soon found very inconvenient, from the difficulty of removal when saturated; the separate lime vessels remedied the defect, which, with the hydraulic main, are said to owe the honor of their invention to the fertile genius of Mr. S. Clegg, the former in 1805, and the latter in 1809. About this time, gas lights were exhibited in London by Mr. Winsor; and by 1819, 288 miles of gas pipes had been laid in the streets of London. In the construction of apparatus for the production of gas, there is first, the distillatory process in cast-iron retorts; secondly, the refrigeratory, or cooling process, which partly takes place in the hydraulic main, and finally in the condenser; and, thirdly, the purifying process, in which the impure gas, as it escapes from the condensers, is rendered fit for consumption.

In no part of the gas apparatus has there been greater ingenuity displayed than in the retorts; and, indeed, as they form the principal item of expense in wear and tear of a gas station, it is of the highest importance to ascertain the kind and form which shall produce the greatest bulk of good illuminating gas from a definite weight of coals, and that they shall be as durable as possible, at the least cost—cast-iron ones seldom lasting more than from nine to twelve months, when they become old iron of the most valueless description. Cast-iron is almost universally used, the dimensions being from six to seven feet long, one to two feet wide, nine to eighteen inches high, from 1¼ to 1½ inches thick, and weighing from 10 to 15 cwts. The forms are various—square, round, oval, flat D, high D, kidney-shaped, &c.—but the D shape is found the prevailing form. At the old company's works, at Liverpool, wrought-iron retorts have been used for many years, the sides and top being made of iron plates, riveted to a cast-iron bottom—length six to eight feet, width about four feet; and it is stated that they were found more efficient and economical than cast-iron ones. At Glasgow, Paisley, and many places in the north of England, retorts are made of fire-clay, generally of larger dimensions than those of cast-iron, the form being D shaped, and from three or four to five inches thick. The manner of setting iron retorts is as much varied as their forms. In small towns requiring but a limited supply of gas, they are set singly; but when a greater supply is necessary, they are set two or three in one fire; and in the largest establishments, the furnaces are of such various dimensions as to contain from three to even nine retorts.

With respect to the production of gas, as to quantity and quality, there is as great a variety as there is in the coals from which it is obtained—some Scotch coals producing as much as 10,000 cubic feet per ton, which would fill a room 100 feet long, 10 feet high, and 10 feet wide. English coals do not produce so much, but probably may be taken on an average at about 8000 cubic feet per ton; and as the greatest portion of the gas is given out in the early part of the distillation, it follows that it must pass rapidly from the hydraulic main; yet, however short the time may be, a large quantity of tar and ammonia is reduced from the gaseous to the fluid state in that vessel, and runs off in the lower part of the main to the tar cistern.

The duration of the process of distillation depends on the quantity of coals in the retorts. Gas managers entertain various opinions on this head, although it is agreed that thin strata and quick distillation produced the greatest quantity of rich gas. When the charge is fully carbonized, the doors are taken off, and the red hot coke drawn out by rakes. As soon as possible after drawing, the retorts are charged again, to prevent any loss of heat by their being left unnecessarily open.

The next portion of the apparatus for consideration is that of condensation. In all well arranged works there is what is called a refrigerator, or condenser, which consists of a considerable length of pipe, through which the gas has to pass, surrounded on the outside with cold water, for the purpose of extracting as much as possible of the heat from the gas. The last process to complete the manufacture of gas for the consumer is that of purification, by which the remaining gaseous impurities which have escaped the condensers, not being condensible, have to be removed by chemical action. For this purpose, two methods are in use, one being that of passing the gas through lime-water—being a mixture of one part slaked lime to 20 or 30 parts of water, being of a consistency very similar to plasterers' lime-wash. The other is that called the dry process, in which the lime is slaked, allowed to cool, and as much water added as to cause it to feel damp, and to retain its shape on being squeezed in the hand, similar to garden mould, or brown sugar. In each of these plans, the gas is passed through successive vessels, until it is thoroughly purified from the sulphur and ammonia with which it is contaminated. The weight of the gas-holder is generally such as to produce a density, or pressure, on the gas of about two ounces per square inch, producing an upward pressure on the cover of the purifier of 18 lbs. per square foot, and which is, consequently, held down by suitable fastenings to the body of the box.

As obstructions occasionally occur in the condenser, or other pipes, between the purifiers and the retorts, by the deposition of napthaline tar, &c., all well arranged works should be furnished with a self-acting escape for the gas, which is being continually generated by the retorts, placed in some conspicuous situation, so that it may be instantly seen when such a contingency takes place. All that is required for this purpose, is an upward opening in the pipe at the end of the hydraulic main, with a water-joint to receive a cylindrical cover, like an inverted cup, dipping into the water-joint, and fastened down. Of course, the depth of this cup, or the altitude of the water, must be more than equal to the resistance arising from all sources, such as the friction of the gas through the condensers, the altitude of water resistance in the wash vessel, the purifiers, and gas-holder.

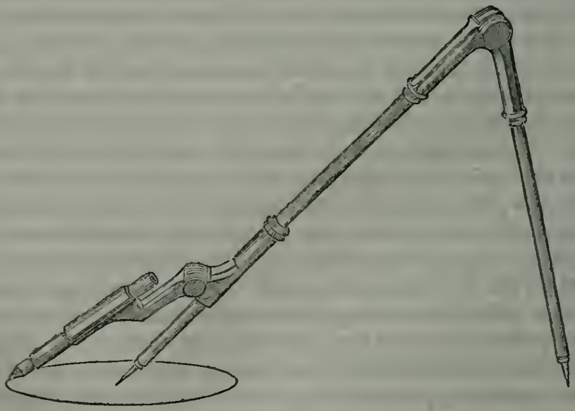
The gas-holder, being merely a vessel of large capacity for containing the gas as purified, is of a most simple kind, not susceptible of much variety, the form first used being still continued, consisting of two parts. The first consists of a circular vessel, or tank, in the ground, with upright sides of brick, or stone, and rendered water-tight by being plastered all round with plastic clay; the pipe conveying the gas from the purifiers is carried down a dry well, rather below the level of the bottom of the tank; at the lowest extremity of the pipe in the well, there is a small close vessel for receiving the liquid ammonia which becomes condensed, and in which is inserted a hand-pump, to draw it off. The inlet pipe is continued under the wall of the tank, and carried upwards to a few inches above the water-level. The gas-holder is a sheet-iron cylinder, open at bottom and closed at top, about a foot less in diameter than the tank; it is made of iron, about one-sixteenth of an inch in thickness, the top being rather stouter, and supported by rafters, suspension truss-rods, &c., and is kept upright in rising by rollers and guide wheels. The great increase in the demand for gas has correspondingly increased the size of the gas-holder; for whereas 50 feet diameter was, 20 years since, considered excessive, they are now made upwards of 100 feet, and of corresponding height. To save the covering so large a superficial quantity of ground, the telescopic gas-holder was invented. This will contain two, three, or four times the cubic contents of the tank, according to the number of slides, and each of them is rendered gas-proof at the edges by having a trough all round, which fills with water when down in the tank, and into which a flanch on the top of the next dips, thus making a water seal. It has been observed that the weight of the gas-holder compresses the gas to a density equal to an altitude of three or four inches of water, but this must be varied to suit the conditions of the district, the distance between the stations of manufacture and consumption, &c. In addition to this, the immense quantity necessary to be sent out in the beginning of a dark winter evening, when almost every light is in full blaze, requires very nice management so to proportion the pressure, that every one may have fair and ample quantity. This was at first done by a common valve, regulated by hand, but it soon became apparent that a better contrivance was necessary. The gas-governor was, therefore, invented. This apparatus is fixed at the gas station, between the gas-holder and the mains; though not quite self-acting, it is, perhaps, as nearly so as possible, to meet the varying circumstances of demand. It consists of a small gas-holder, balanced by a number of shifting weights, by which its specific gravity, when more or less immersed in the water, regulates the supply to the demand, under whatever pressure it is adjusted. The gas enters through a centre pipe, in which there is an iron cone suspended; the top has a plate, with a hole perfectly circular, to fit the base of the cone. It is, therefore, clear that if this cone is drawn up close, no gas can escape—but if, on the contrary, quite down, a full flow will take place. The superintendent, therefore, in the beginning of the evening, takes off as many weights, as will adjust the annular orifice between the cone and the cap-plate, to produce the pressure required, which is indicated by a gauge in the top of the vessel. The gas in this governor is, of course, under the constant pressure of the main gas-holder.

The last portion of this subject, which interests the public, is the meter, which, as we have so often treated on before, and as an article on the subject will be found in another column, we must here close these remarks. Lond. Min. Jour.

Elliptographic Compass.

(From the Glasgow Practical Mechanic and Engineer's Magazine.)

Mr Editor,—I beg to forward you a sketch of a simple instrument for drawing ovals, which I made several years ago, from a figure in an old work, and which only requires to be known to come into general use, as, from its simplicity and ready action, it will be found of great service to the perspective draughtsman. The construction is so simple as not to require a detailed description. To use it, set the point of the leg on which the pencil slides, in the centre, and the pencil to the half breadth of the ellipse, then extend the steadying leg until the pencil, as in the position shown in the figure, cuts the length; steady the instrument with one hand, and with the other turn the pencil round, allowing it to slide up or down its guide, so as to keep the point pressing lightly on the paper. It must be clear that the figure described by the revolution of the pencil is a perfect ellipse, as it is an oblique section of a cylinder. When the ellipse is very long, this in-



strument will not answer well, but for a large proportion of those which occur in perspective, it will be found very useful; in this I can speak from experience.

I have shown both legs adapted to receive the pencil, and those of different lengths, as it will be more convenient than the old form with one round leg, if the ellipse is wanted nearly circular.

Yours, &c. G. H. S.

Improvements in Blast Furnaces, patented by Mr. James Yates, *Masborough, Yorkshire, December* 14, 1846.

The patentee states, that it is usual to keep the charge, in blast furnaces of ordinary construction, for as long a time as is compatible with the iron made; and that it is deemed beneficial to continue *the cementing process,* which is the result of the iron-stone, or ore, and fuel, being subjected to a great degree of heat for several days; but that he believes this system of operation to be erroneous.

Again, under the system which has hitherto prevailed, furnaces are kept filled up to the funnel-head, through which the flame and unconsumed products pass on escaping from the charge; and these furnaces are constructed in the form of two cones united at their bases, or of a cylindrical form at top; both of which forms of construction offer scarcely any obstacle to the free escape of caloric with the unconsumed products.

Now Mr. Yates proposes *firstly*, to arch in the upper part of the furnace, and diminish its height, in order that a very considerable portion of heat, instead of escaping as heretofore, may, after striking against the even surface of the dome, be deflected on the top surface of the "burden" and absorbed by it. *Secondly*, to place feed-doors, by which the material may be introduced in the side, at that point of junction between the dome and the bottom part of the furnace which allows of the largest surface of the burden being exposed to the action of the deflected heat (care being taken to maintain a sufficient and uniform space between the dome and top of the "burden" for the purposes of reverberation); by which mode of charging the furnace the "burden" is hollow in the centre, and therefore offers less resistance to the blast, which is regulated by means of dampers suitably placed in the chimney. And *thirdly*, to employ a greater number of tuyeres, and to distribute them more equally round the hearth of the furnace than has yet been customary; and to provide each tuyere with a separate house, in order that the blast may act more regularly on the "burden."

The results of these alterations are stated to be saving in the prime cost of erection, and economy both in fuel and in engine power.

Mr. Yates instances a furnace, built according to his invention, which was 20 feet from the hearth to the top of the "burden," and had six tuyere pipes of seven-eighths of an inch in diameter; with this furnace he produced, employing a hot blast at a pressure of 1½ lbs.

to the square inch, 110 tons of iron, from lean Derbyshire ore, in one week.

The patentee proposes to adapt his plan of construction to existing furnaces, by building the dome in the top, or other part of the shaft, and providing feed doors, together with the necessary holes for the extra number of tuyere pipes.

After pointing out various modifications of which his invention is susceptible, such as, the substitution for tuyere pipes, of a circular passage, with grating to keep in the " burden," Mr. Yates proceeds to describe a peculiar apparatus for feeding by the chimney instead of by side doors, which enables him to obtain the same result, viz., the distribution of the material around and upon, and not in, the centre of the " burden." The apparatus referred to is fixed in the dome, and consists of a cone, having an aperture in its centre for the passage of unconsumed products, and is adjusted to the required size. The cone is made fast to a lever passing through the chimney, and weighted at the outside end ; so that when there is no disturbing force, its weight shall keep the cone wedged tight up into the dome, and leave no room for the escape of any vapor or caloric, except through the aperture. A feed-box is suspended in the chimney, and has a conical bottom, similarly connected to a weighted lever, which, when the box is filled, falls down, and allows the passage of the material ; the centre aperture of the under cone being covered by the bottom of the feed-box. The weight of the material falling on the surfaces of the under cone, overcomes the weight at the end of the lever, and depressing the cone, passes into the furnace around the sides. When there is no longer any weight on either the cone portions of the dome, or the conical bottoms of the box, they both return to their places.

Other modifications described in this specification are, the connecting two or more furnaces to a common chimney, by flues provided with dampers to regulate the draught; the making the furnace of as great a diameter at the bottom, just above the hearth, as at the other point of junction with the dome, or even greater : and a peculiar construction of tuyere box, to avoid, in a great measure, the melting of the tuyere pipes.

The patentee describes, lastly, some improvements relating to steam-engines and cylinders employed in blasting, which may be said briefly, to consist in working two engines together, by connecting the slide valves and rods of the one to the piston-rod of the other, and *vice versâ,* so that the piston at work shall open the valves of the one at rest ; and in using an elastic cylinder attached immovably at one end to the main, and at the other to the piston-rod. By the use of this elastic cylinder, Mr. Yates states that a more regular pressure of the blast may be obtained. London Mec. Mag.

Description of Brett & Little's Electric Telegraph.

We have witnessed an exhibition of the improvements effected by Messrs. Brett and Little, of Furnival's Inn, in the construction and working of that marvel of modern science, the electric telegraph:—and will borrow a description of the same for the information of our scientific readers:—"The inventions of Messrs. Brett and Little aim at increasing the efficiency of the electric telegraph, in the first place, by generating and economizing a more constant and powerful electric current; and secondly, by a new arrangement of the dial and indicator, insuring that communications may be made more safely and certainly than by the system now in use. The increased power is attained by a process which frees the copper and zinc plates in the batteries from the sulphate of zinc which ordinarily accumulates upon them, and which soon diminishes their force. Messrs. Brett and Little's apparatus consists of three troughs, placed one above another. The highest is a reservoir containing the exciting power, a diluted sulphuric acid; the middle trough is the galvanic battery, containing the copper and zinc plates, divided by cells or compartments of fine sand; and the lowest trough receives the vitiated liquid, which, having slowly dropped from the reservoir into the battery, has filtered through the sand in the latter, and thence percolates, drop by drop, into the receiving trough below. The diluted sulphuric acid drops from the reservoir into the galvanic battery through small cones perforated at the bottom,—and is carried from the bottom of the galvanic trough by corresponding cones and perforators into the receiving trough. The sand which surrounds the metallic plates is thus constantly saturated; and, as a constant supply of fresh acid is kept up, and the vitiated fluid as constantly escapes below, the formation of crystals of the sulphate of zinc is prevented by this self-cleansing process, and the whole surface of the plates is exposed to the action of the acid. The fluid in the receiving-trough is found to contain large quantities of the sulphate of zinc, which would, in the ordinary mode, have adhered to the plates, and prevented the action of the acid upon the metal.. The second feature in the invention of Messrs. Brett and Little is the new alphabet, and the altered face of the dial adopted by them. The indicators attached to the dials hitherto in use are generally magnets, and their incessant vibration, through electrical and other disturbing atmospheric causes, has produced much uncertainty and confusion in communications. The indicators in the dial before us are not magnets, and show no vibration whatever. Another point of difference is, that in the dial of Messrs. Brett and Little, every letter in the alphabet is given, with the means of expressing it,—so that no symbols or arbitraries need be used, and a sentence may be perfectly and entirely spelled, and transmitted as it is written."—In one of their rooms, the patentees have seventeen instruments fitted up to represent seventeen stations; and the electric current passes through coils of wire, to each of these instruments, equal to 1000 miles in length. There are other devices and improvements in the same exhibition, such as a new and ingenious bell apparatus, lightning-conductors, and insulator. The whole is well worthy the attention of scientific men. London Athenæum.

Communication of True Time by the Electric Telegraph.

The Electric Telegraph Company are now making arrangements to communicate the true time, as observed daily at the Royal Observatory at Greenwich, to every station on the various lines of railway where the Company has a telegraph station, and, of course, to all large towns throughout the kingdom. It is now the daily practice at Greenwich, at 1 P. M., to indicate the true time by dropping a ball from the upper part of the Observatory, which, being telegraphed to the Admiralty, and signalled to the shipping on the Thames, enables ships' chronometers to be adjusted. The Telegraph Company intend that the ball, immediately on being detached at the top of its fall, should strike a spring, which, connected with the various lines of electric wires of the Company, will instantly strike a bell at every station. Thus, it is not only possible and practicable, but what, in all probability, will be a matter of daily experience ere very long—that before the ball at the Greenwich Observatory shall have reached the ground in its fall, the electric bell at Manchester will have struck and been set ringing; so that we shall know it is 1 P. M. at Greenwich before the ball announcing that fact has finished falling a few feet.

Lond. Mec. Mag.

Metallic Mirrors made in China.

In another paper, M. Stanislas Julien spoke of the metallic mirrors made in China, and to which the name of magic mirrors has been given. Hitherto all attempts by Europeans to obtain information as to the process, in the localities where they are manufactured, have proved failures; some of the persons applied to being unwilling to reveal the secret, and others being ignorant of the process. These mirrors are called magical, because if they receive the rays of the sun on their polished surface, the characters, or flowers *en relief*, which exist on the other side are faithfully reproduced. The following information has been obtained by M. Julien, from an author named Ou-tseu-hing, who lived between 1260 and 1341. This author says:—"The cause of this phenomenon is the distinct use of fine copper and rough copper. If, on the under side, there be produced, by casting in a mould, the figure of a dragon in a circle, there is then engraved deeply on the disk a dragon exactly similar. Then the parts which have been cut are filled with rather rough copper, and this is, by the action of fire, incorporated with the other metal, which is of a finer nature. The face of the mirror is next prepared, and a slight coating of tin is spread over it. If the polished disk of a mirror so prepared be turned towards the sun, and the image be reflected on a wall, it presents distinctly the clear portion and the dark portion, the one of the fine, and the other of the rough copper." Ou-tseu-hing states that he had ascertained this by a careful inspection of the fragments of a broken mirror.

London Athenæum.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA,

FOR THE

PROMOTION OF THE MECHANIC ARTS.

DECEMBER, 1847.

FRANKLIN INSTITUTE.

Seventeenth Exhibition of American Manufactures, held in the city of Philadelphia, from the 19*th to the* 30*th of October, inclusive,* 1847, *by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts.*

Address by Owen Evans, Esq.,

Chairman of the Committee on Exhibitions. Delivered on announcing the Premiums awarded.

Ladies and Gentlemen:—Our present exhibition presents highly gratifying evidence of the growth of American manufactures, and gives a prescience of the perfection they are destined to attain. Every year there is a curtailment of our dependence upon the workshops of other countries, and every year do we thus assert our increased importance as a nation. Idleness forms no part of our character. By dint of skill, perseverance, and industry, we successfully compete with densely populated districts of other countries, and effect revolutions in trade as remarkable and startling as any that occur in governments. There is, in the American people, an innate energy, seeming to have a latent existence, that is equivalent to whatever task is imposed—material for any and every emergency. We have but to proclaim a want, and it is met, let the obstacles be what they may. The pen, the pencil, and the chisel have as distinguished masters among us as in any other nation, although the pursuits are attended with much less promise of emolument in fame or fortune than where court patronage is attainable.

Our mechanic arts are not more remarkable for their rapid progress than for their variety—a variety not attempted any where else, and in many branches their excellence is unrivalled.

There is also to be distinguished, a creditable effort to harmonize fashion with comfort, convenience, and utility, but there is yet much room for improvement in this feature. In this particular we also bear honorable comparison with other nations.

To the Franklin Institute undoubtedly belongs much credit for our progress in the Mechanic Arts. All its efforts are directed to this purpose; but the encouragement of the Mechanic Arts is not the only province of its usefulness. There is no institution in the country where so much valuable information may be obtained so cheaply. A young man whose mind is open to instruction finds in the Institute facilities for acquiring knowledge in almost any useful pursuit, and, by awakening a taste for what is useful, he may be induced to a career honorable to himself and valuable to his fellow men; whereas, had not the Hall of the Institute been open to him, some of the very many attractive doors of idleness and dissipation, that are always open, would have enticed him to deeds and pastimes in which there would have been neither credit nor profit. But my capacity would serve but feebly in laying before the community the favorable considerations to which the Franklin Institute is entitled.

We are compelled to the same course this year as last in regard to the general report. The reports of the judges were, many of them, delayed to so late a period that it was impossible to get the general report ready to read at the close of the exhibition.

We take the present opportunity to tender thanks to the judges for their valuable services. The branches allotted to the ladies received the same careful attention this year as last—their reports bear abundant testimony to the industry and zeal of the compilers, and we tender our sincere thanks to them. We also thank the Committee of Arrangement, the depositors, and the visitors.

Although we rarely find, at any one exhibition, all the branches of manufactures fully and correctly represented, yet there is always sufficient to prove that they are advancing; and although we believe the manufacturers neglect their interests in failing to avail themselves of such opportunities to inform the consumers what they can accomplish, there is sufficient to manifest the advantage of holding the exhibitions. An important feature in their usefulness is the fact that they are gradually wearing away the prejudice against articles of home production. A reaction is taking place in the community in this respect—a patriotic ambition to possess the handiwork of the American mechanic.

REPORT OF THE COMMITTEE ON EXHIBITIONS.

The Committee on Exhibitions, of the Franklin Institute, respectfully present the following report concerning the Seventeenth Exhibition, which has just closed.

In the performance of this duty, they are gratified at being able to state that the general result has been, in a high degree, satisfactory and encouraging. The quantity and variety of the goods and articles deposited was very extensive; most of the departments of manufacturing industry being well represented, and nearly all showing decided evidence of the progress of improvement in material, fabric, workmanship, and finish.

They are renewedly convinced, from present as well as past experience, that these periodical exhibitions of the productions of our manufacturers, mechanics, and artizans, exercise a beneficial influence, not only upon the general progress of the arts and manufactures of our country, but upon the direct interests of those who avail themselves of these opportunities to display specimens of ingenious invention, improved construction, or of excellent or creditable workmanship. In viewing this immense collection of substantial, useful, ingenious, or elegant articles, adapted to almost every conceivable purpose of utility, convenience, or luxury—the mind of every impartial observer must have been impressed with the conviction that our country is now able to supply most, if not all, of our wants, without recourse to foreign workshops for aid.

In the arrangement of articles in the rooms, care was taken to observe as much symmetry and order as possible, so that the general grouping and effect might be harmonious and pleasing. From the satisfaction expressed by visitors in relation to this subject, it is believed that, in this difficult point, considerable success was attained, and that the general arrangement was superior in effect to that of any former exhibition. Experience and careful attention will, in future, lead to still more improvement in this respect.

The number of deposits brought in too late for entry on the judges' lists is, this year, smaller than usual; but still many excellent articles have failed to receive notice in consequence of not being entered in time.

The awards made by the Committee have been those recommended by the judges who were selected to examine the articles in each department of the exhibition. These judges were experienced persons, selected on account of their acquaintance with the respective branches on which they were appointed; and great care was taken to guard against any improper influence or interest in the decision which they might make. If injustice has been done, or if meritorious articles have been neglected, or overlooked—it should be attributed to the difficulty of minutely examining and considering every article in such an immense collection, and not to intentional neglect, or a partiality for particular depositors. The Committee have long since learned that it is impossible to please all: but feel conscious that they have endeavored, in all things, to perform their duty with strict justice and impartiality.

Annexed is a general summary, compiled from the reports of the judges in the several departments of the exhibition.

I.—*Cotton Goods.*

The judges regard this as one of the most important branches of our domestic industry, and express their regret that the display was not commensurate with its utility as a public benefit.

To each of the following named articles, regarded as the best of their kind, a First Premium is awarded:—

No. 42, tickings, by R. Garsed & Bros., Frankford. Remarkable for excellence of fabric, evenness of finish, and purity and distinctness of color.

No. 95, heavy brown sheetings, from the Conestoga steam mills, Lancaster, Pa., deposited by David S. Brown & Co. These the judges consider as the perfection of that kind of goods; possessing the elements of great durability, with an evenness and beauty of fabric and finish hitherto unapproached.

No. 78, cotton prints, by J. Briggs & Co., Frankford. In delicacy and richness of coloring, and in distinctness of figure and ground, these goods are considered as evidence of great skill in the art of printing cottons. The judges remark that the general display of prints at the present exhibition, shows very great improvement in the production of solid grounds, as well as in the clearness with which the figures are defined.

No. 64, Cashmere d' Ecosse, from the Manchester mills, N. H., deposited by Robert Ewing. A new article of American fabric, and a very good specimen with regard to both style and finish.

A Second Premium is awarded to Goodall & Co., of the Philadelphia bleach works, for bleaching yarns and Canton flannels in a very superior manner.

The judges notice with commendation No. 4, cotton curtain fringe, by Henry Hetzel, deposited by W. P. Hollingsworth, Philadelphia; No. 106, cotton pantaloon stuffs, by Joseph Ripka; and Nos. 109, 110, by Kempton & Coppuck, Manayunk.

The bleached muslins, and other goods, from the New York mills, maintain their well established character for excellence. In ginghams, furniture prints, Canton flannels, and mousselines de laine, but little improvement is noticed.

II.—*Woolen Goods.*

This department of manufactures was comparatively much better represented in the exhibition than that of cottons. It was examined by experienced judges, who recommend First Premiums to the following:—

No. 115, white ribbon-bound blankets, by W. C. Warner, of Philadelphia, deposited by David S. Brown & Co. A very beautiful and well-made article.

No. 92, black cloths, by W. & D. D. Farnum & Co., Waterford, Mass., deposited by D. S. Brown & Co. The judges consider these cloths very superior: the material being of the best quality, and the workmanship showing the superior skill of the makers.

This matter having been referred back to the judges, they declare that their intention was to represent these cloths as the finest exhibited by the Institute within their knowledge, and that their superior make and finish fully entitle them to the highest award in the power of the Institute. The Committee therefore refer the subject relating to these cloths to the Institute for determination.

No. 127, black, blue, and green blanket coatings, by the New England Company, Saxonville, Mass., deposited by Pease & Foster. Highly creditable to the makers.

No. 35, assorted Cashmeretts, by Hill, Carpenter & Co., Providence, R. I., deposited by D. S. Brown & Co. A new article of American manufacture: the work and finish are of the highest order.

No. 91, French style fancy cassimeres, by W. & D. D. Farnum, Waterford, Mass., deposited by D. S. Brown & Co. The superior style and quality of these goods give evidence of great perfection in American manufacture.

No. 24, worsted embroidered shawls, by Duncan & Cunningham, Belleville, N. J., deposited by D. S. Brown & Co. A very superior article: the embroidery being highly creditable to the skill and enterprise of the makers.

Nos. 27, 28, embossed table covers, by Duncan & Cunningham. Tasteful in style and pattern.

Nos. 39, 40, woolen and worsted yarn, by M. & E. Hey, Springfield, Delaware county, Pa. Exceedingly well made, and giving evidence of great improvement in this branch of manufacture.

A number of fleeces of excellent wool were deposited, which were considered worthy of premiums; but the names of the growers being unknown, the premiums cannot be given.

To the following named articles a Second Premium is awarded:

No. 67, assorted cloths, by the Utica Steam Woolen Company, N. Y., deposited by Thomas & Martin. Exceedingly well made and creditable goods.

No. 102, fancy black cassimeres, by Wethered & Bro., Baltimore, deposited by Todhunter & Sill. Deserving the premium for style and finish more than for quality.

Nos. 18, 29, 30, Oxford mixed and black doeskin cassimeres, by W. & D. D. Farnum, Waterford, Mass., deposited by D. S. Brown & Co. Well made and handsomely finished.

Nos. 19, 31, 32, 34, mixed cassimeres, by Hill, Carpenter & Co., Providence, R. I., deposited by D. S. Brown & Co. Very desirable goods: worthy of encouragement.

No. 20, printed piano covers, by W. & L. W. Duncan, Belleville, N. J., deposited by D. S. Brown & Co. Considered by the judges to merit a premium for the style and printing.

The judges notice favorably in their report, the following, as very good articles: Mackinaw and twilled blankets, by the Gonic Manufacturing Company, deposited by D. S. Brown & Co. and R. C. Niles. Colored cloths, by the Hamilton Woolen Company, deposited by J. S. Dunlap. Satinetts, by Camp & Norris, Woodbury, Conn., deposited by C. H. Welling. Merino cassimeres, by Thos. Drake, Philadelphia, and white bed blankets, by the New England Company, deposited by Pease & Foster. Imitation cassimeres, printed by C. S. Marshall, Philadelphia. Striped and plaid wool filled cassimeres, by Kempton & Coppuck.

III.— *Carpetings.*

There was but a meagre display of goods in this department, and the judges report nothing deserving of special notice except No. 320, oil cloths, table stand, piano covers, and rugs, by Jas. W. Woodruff, Elizabethtown, N. J., to whom is awarded a Third Premium for the rugs.

IV.—*Silk Goods.*

A First Premium is awarded to J. C. Dobleman, of Philadelphia, for silk fringe, of superior coloring and good workmanship, made from American silk.

A Second Premium to Godfrey Greul, Philadelphia, for No. 48, coach lace and silk fringe, of superior workmanship, made from American silk.

A Third Premium to John Crabtree, Staten Island, for printing silk handkerchiefs.

Nos. 17, 23, embroidered shawls, by Duncan & Cunningham, Belleville, N. J., are a beautiful article, and fully equal to specimens formerly exhibited, for which the makers have received premiums.

The judges notice in terms of commendation: No. 49, sewing silks, by G. W. Foss & Co., Mansfield, Conn.; and No. 70, silk bonnet wire, by Joseph Moore, Philadelphia.

V.—*Iron and Steel.*

The judges on this important branch of manufacture express their gratification at being able to state that there is an evident improvement in the making of rolled iron, of the various sizes and patterns; noticing, at the same time, that the manufacturers appear to have turned their attention almost exclusively to this branch of the business. The manufacture of hammered iron is consequently neglected; a circumstance which the judges regret, as they consider hammered iron to be nearly as important as that which is rolled. They are sorry to observe the indifference manifested by our iron manufacturers with regard to exhibiting; nearly all the iron in the present exhibition having been deposited by the firm of Morris, Jones & Co., who deserve great credit for their zeal in promoting the object of the Institute in this important department.

A First Premium is awarded to No. 1716, twenty bars of rolled iron, by Moore & Hooven, Norristown, Pa., deposited by Morris, Jones & Co. This iron is exceedingly well handled: the bars are round, well straightened, and trimmed at the ends. It is believed to be of good quality.

A Second Premium to No. 1718, six sheets of boiler iron, made by Henry Potts & Co., Pottstown, Pa., deposited by Morris, Jones & Co. These are the largest sheets of boiler iron that have been exhibited, being 22 feet long by 30 inches broad; the largest of them weighing 585 pounds. They are well rolled, and appear to be of good quality.

The judges make favorable mention of No. 1535, ten bars of charcoal hammered iron, by Jacob B. Weidman, Lebanon county, Pa. Very neatly hammered, and of good quality. No. 1560, a lot of rolled iron of various sizes, and a bundle of wire rods, by Thomas & Ogden, Philadelphia. Very handsomely rolled, and of good quality; but not superior to that for which they received a premium at the last exhibition. No. 1722, rolled iron, by James Rowland & Co., Philadelphia. Neatly rolled, and considered to be a very creditable article. No. 1719, circular sheets of boiler iron, by Yearsley & Bro., Coatesville, Pa.; No. 1720, boiler iron, by J. & J. Forsyth & Sons, Gallagherville, Pa.; No. 1721, do., by Rowland & Hunt, Cheltenham, Pa.: all handsomely made and good articles. No. 1572, slit rods, by Valentine & Thomas, deposited by Samuel Milliken, of good quality, and equal to those formerly exhibited.

VI.—*Umbrellas.*

The quantity and variety of goods in this department of the exhibition is, this year, unusually small. The judges have not thought proper to recommend any awards, but notice No. 114, a case of umbrellas and parasols, by Wm. A. Drown, as containing many handsome specimens of skill and good taste. Also, No. 120, cane umbrellas, by W. H. Richardson; an improved article, of great convenience to travelers.

VII.—*Lamps and Gas Fixtures.*

A principal part of the display in this division of the exhibition is derived from the extensive establishment of Cornelius & Co., of Philadelphia; their assortment of ornamental lamps and gas pendants being fully equal to the productions of former years. The magnificent chandelier made by them for the Opera House at New York, surpasses all heretofore exhibited in beauty and effect. For it a First Premium is awarded.

To E. Whelan & Co., Philadelphia, for parlor chandeliers, of tasteful design, a Third Premium.

The lard lamps by J. W. Henry, of Philadelphia, and H. P. Kelsey, are equal in excellence to those of last year.

The so-called portable gas lamps, by E. J. Clause, give a pleasant and cheap light, derived from an inflammable liquid mixture; but, in the opinion of the judges, do not appear to be exempt from danger, if used carelessly.

VIII.—*Hardware and Cutlery.*

In this interesting and well sustained department, the judges express their gratification in being able to remark that the specimens exhibited evince, on the part of the manufacturers, a determination to maintain the high reputation which has been acquired in this branch of American industry. They desire that this remark should be understood as universally applicable to the articles submitted to their inspection.

To each of the following, a First Premium is awarded:—

No. 603, guns and pistols, by John Krider, Philadelphia. The workmanship of these, especially the double barreled rifle, and shot gun, is of the best kind; they are neat, well proportioned, substantial, and finished with excellent taste.

No. 637, axes, by Wm. Mann, Jr., Lewistown, Pa., deposited by Martin Buehler & Bro. The judges consider these as the best article of the kind ever examined by them. The surfaces are remarkably free from flaws; the tools are well proportioned and elegantly finished.

No. 675, gilt buttons, by Wadhams & Co., Wolcottville, Conn., deposited by D. D. Byerly. Elegantly finished in all respects, and showing a high state of perfection in this branch of manufactures.

No. 719, samples of stocks and dies, by J. M. King, Waterford, N. Y., deposited by Curtis & Hand. These articles appear to have been made with great care in all respects, in the forging, filing, tempering, and finishing.

No. 684, cast-iron butt hinges, by W. P. Cresson, Philadelphia. Remarkable for excellence of finish in all respects.

A Second Premium is adjudged to each of the following:—

No. 602, hammers and sample tools, by B. Richardson & Son, Philadelphia. Very well made, highly finished, and well adapted to the uses to which they are to be applied.

No. 646, augers, by A. Conard, Whitemarsh, Pa., deposited by Thompson, Carr & Co. Highly creditable to the taste and skill of the maker.

No. 645, saddlers' tools, by James M. Huber, Philadelphia. Well made articles.

No. 678, saddlers' tools, by J. Steiner & Co., Philadelphia. Very creditable to the makers.

No. 714, hoes, tobacco knives, &c., by Canfield & Co., Newark, N. J. Well got up, in every respect.

No. 628, brass cocks, by Odell and English, Baltimore. Well made, well finished, and beautiful specimens.

The makers of the following named articles have mostly, if not all, received first premiums at former exhibitions for the excellence of their manufactures. The present specimens fully sustain the deservedly high reputation of their respective makers:

No. 611, brass cocks, by Lambe & Co. 612, saws and tools, by W. P. Cresson. 632, planes, by E. W. Carpenter. 633, stocks and dies, by B. Martins. 649, brass ware, by Frederick Jordan. 658, edge tools, by John Beatty. 659, butt hinges, by Roy & Co. 670, files, by R. Murphy. 671, shoemakers' tools, by C. H. Blittersdorf. 673, carriage and machine bolts, by E. & P. Coleman. 698, planes, by John Colton. 717, screws, by the N. E. Screw Company. 722, wrenches, by S. Merrick, Springfield, Mass. 609, shears, by R. Heinisch.

The judges deem it but justice to notice particularly the substantial and well made stand of vises, made by Fisher & Martin, of Newport, Maine. A similar article, from the same makers, is now in the hands of the Committee on Science and the Arts, for examination.

The following are specially commended by the judges as deserving of favorable notice: No. 601, scythes, by R. B. Dunn, dep. by J. J. Duncan & Co. 607, scythes, by J. S. Chandler & Co., dep. by E. S. Handy & Co. 620, scythes, by Roby & Sawyer, dep. by Edw. Lewis. 615, shovels and spades, by David Snyder. 626, shovels, by James Wood & Sons. 629, shovels, by John Weightman. 631, spades, by T. & B. Rowland.

Special praise is also bestowed in the judges' report upon No. 616, ship caulkers' tools, by Wm. Noble; 624, hoes, by J. Souder; 627, post hinges for gates, by Seymour & Bro.; 636, bridle bits, &c., by John Robbins; 635, gun locks, by James Golcher; 614, hatchets, by Chas. Sonntag; 642, weaver's steel reed, by J. A. Gowdey; 653, locks, by A. Prutzman; 655, locks and latches, by Livingston, Roggen & Co.; 660 & 661, hinges and shutter fastenings, by Seymour, Bro. & Co.; 674, sad irons, by Carr & Haines; 691 & 692, locks, by Joseph Nock; 701 & 716, shoe knives, by J. & L. Ames; 702, screw drivers, by Chas. Souder; 720, iron pump and waffle irons, by Auger & Lord; 721, waffle irons, by Chapman, Randall & Co.; 606, coffee mills, by J. Kirchberg; 654, do. by W. C. Lawson; 669, do. by Livingston, Roggen, & Co.; 619, gardener's tools, by H. A. Dreer. They also notice No. 647, samples of improved patent fish hooks, as a well made and very ingenious contrivance. The razor strops by C. Y. Haines, and also those by Snyder & Morris, are a fair creditable article.

Among the wire work, the following are mentioned as very creditable to the makers, and worthy of the special notice of the Institute. Nos. 1538, 1539 & 1540, woven wire, sieves, and dish covers, by Watson & Cox; 1648 & 1676, woven wire, by W. M. & J. B. Wickersham; 1653, wire cloth and sieves, by J. & D. Sellers; 1682, woven wire, twilled and plain, by James Douglass.

A number of excellent articles in the collection of hardware were brought in too late to be entered on the judges' lists; and some o those which were entered in time, they were unable to find.

IX.—*Saddlery and Harness.*

The display of saddlery and harness was not extensive, and, as a whole, in the opinion of the judges, decidedly inferior to previous exhibitions. The deservedly high reputation of our Philadelphia mechanics in this branch of business, could scarcely be ascertained by a visit to the present exhibition. There is no doubt that an excellent and highly creditable assortment might have been made, of articles taken from the cases of the manufacturers, intended for their ordinary sales. So much apparent apathy in this department is to be regretted,—and a hope is indulged that, at future exhibitions, the well known taste and skill of our mechanics may be more fully represented. Should this not be the case, an opportunity will be furnished to manufacturers from distant places to carry off the honors of the Institute.

A First Premium is awarded to Robert Carey of Philadelphia, for a Shaftoe saddle, No. 439, of good style and excellent workmanship.

Second Premiums to the following:

No. 314, a russet traveling trunk, by Thomas W. Mattson, Philadelphia, considered by the judges as an excellent article.

No. 406, a trunk of patent leather, by John Unruh, Philadelphia.

No. 407, a valise trunk, by W. P. Taylor; tastefully and substantially made.

No. 396, a russet traveling trunk, with drawers, by Jacob Moyer, Philadelphia, of good workmanship.

A Third Premium is adjudged to No. 404, a mail coach trunk, by E. P. Moyer, a convenient, light and substantial article. Also to No. 398, cowhide whips, by Charles Cummings, Philadelphia, very creditable specimens of this kind of goods.

The judges mention favorably, No. 315, single harness, by W. W. Moyer. No. 335, saddle trees, by Baldwin, James & Co. No. 327, ornaments for harness, by F. C. Key, Philadelphia. No. 433, a hatbox, by Charles Coward; and No. 371, a saddle, by George Tees.

Several other trunks and valises were deposited; but being locked, the judges could not examine them fully.

X.—*Models and Machinery.*

The judges appointed to examine this department of the exhibition, report that they have devoted considerable time to the duty; but fear that it has not been completely performed, in consequence of the great extent and variety of the deposits in this branch. They suggest that their labors would be essentially diminished by meeting upon the days appropriated to receiving goods, prior to the opening of the exhibition; whereby a better opportunity would be afforded for examination, and exclusion of articles unworthy a place in the exhibition; and also for consultation with the inventors, when desired. The limits of their report not affording sufficient space for even a brief notice of all the articles entered upon their list; they have confined themselves to an enumeration of such as are deemed worthy of awards, or especial commendation.

Some of the machines which would require more extended trial and examination than the short period of the exhibition allows, are referred to the notice of the Committee of the Institute on Science and the Arts, to whom such investigations properly belong.

To this class belong the following:

No. 1542, a tubular steam boiler, by James Montgomery, of Tennessee.

No. 1564, a direct action steam hammer, by L. Kirk, Reading, Pa.

No. 1576, samples of fire brick, by Dager & Potts, Montgomery co., Pennsylvania.

No. 1586, smut machine, by J. Johnson, Wilmington, Del.

No. 1609, rotary steam engine, by James Black & Co., Phila.

No. 1659, rotary blast generator, by C. C. Lloyd, Philadelphia.

To the following named articles, First Premiums are awarded:—

No. 1554, a cutting press, by J. S. Eckfeldt, of the U. S. Mint. Of this article the judges remark that it is not inferior to the hitherto unsurpassed productions of that establishment, in tastefulness of design, fitness of proportions, and exquisite beauty of finish.

No. 1553, a card printing press, by S. P. Ruggles, of Boston deposited by James Young. Of great simplicity and rapid action.

No. 1550, a weighing cart, by J. A. Stewart, Philadelphia. This cart is provided with a compound lever balance, for weighing the load placed in it: appearing to be a successful attempt at constructing an article which promises to be extensively useful.

No. 1697, wrought iron tubes, by Morris, Tasker, & Morris, Philadelphia. These tubes, intended for steam, gas, or water, manifest great skill in this important manufacture.

No. 1672, hydraulic rams, by Henry Birkenbine, Philadelphia. In the construction of these machines, of various sizes, for raising water, the manufacturer appears to have been highly successful.

No. 1737, power loom, by James Nield, Taunton, Mass. This loom is furnished with a rotating shuttle box, admirably adapted to weaving plaids, carpeting, &c.

No. 1727½, locomotive chimney, with spark arrester, by French, Baird, & Campbell, Philadelphia: the efficiency of which is satisfactorily attested.

The two following were adjudged worthy of a First Premium; but Mr. Whitney and Mr. Agnew being members of the Board of Managers, are precluded by our rules from receiving any award:

No. 1583, railroad wheels, by A. Whitney & Son, Philadelphia. These wheels are cast with chilled rims, and then annealed in such a manner as to prevent the unequal tension which renders such castings peculiarly liable to fracture.

No. 1615, seal press, made for the U. S. District Court, by John Agnew, Philadelphia. A very well made and excellent article; worthy of the distinguished reputation of the maker.

Second Premiums are awarded as follows:—

No. 1522, S. P. Miller of Philadelphia, for a machine for hand pressing bricks.

No. 1529, T. S. Speakman, Philadelphia, for a rock excavator, believed to be a useful machine.

No. ——, D. O. Prouty, Philadelphia, for an extensive display of useful agricultural implements.

No. 1575, R. D. Ford, Philadelphia, for a slide rest, excellently finished: deposited by Dr. Beck.

No. 1635, Adam Gawthrop, Chester co., Pa., for an hydraulic ram.

No. 1523, Benjamin Wiggins, Bucks county, Pa., for an improved plough, of excellent model and finish: the mechanical work by George Buckman.

No. 1524, Taylor & Flagler, Peekskill, N. Y., for a portable forge; very complete and compact.

No. 1525, Evans & Watson, Philadelphia, for a portable water closet; judiciously contrived.

No. 1649, John Mc. Clintock, Philadelphia, for a mortising and tenoning machine.

Nos. 1676–7, Henry Jenkins, Pottsville, Pa., for woven wire and wire railings.

No. 1728, James Smith & Co., Philadelphia, for machine cards, made in the exhibition, on their beautiful and compact card setting machine.

No. 1733, J. H. Stewart, Philadelphia, for his improved card printing press.

No. 1678, Joseph Turner, Kensington, for an improved spinning machine.

Third Premiums to the following:

No. 1547, Joseph Jones, Camden, N. J., for a boring machine for the use of wheelwrights and joiners.

No. 1569, B. R. Smith, Philadelphia, for a double action lifting pump, ingeniously contrived.

No. 1669, William Willard, Philadelphia, for leather hose, well made.

No. 1627, Thomas Jackson, Reading, Pa., for samples of flat rope.

The judges also mention the following as worthy of favorable notice and commendation:

No. 1511, Printing Press, by Adam Ramage, Philadelphia; 1702-3, copying and seal presses, by Charles Evans, Philadelphia; 1543–4–5, platform and other scales, by E. & T. Fairbanks, St. Johnsbury, Vt,; 1581, platform scales, by Ellicott & Abbott, Philadelphia; also platform scales by Root & Chase, York, Pa., by Livingston & Roggan, Pittsburg, and by Gottlieb M. Barth, Philadelphia; 1503, hay rakes, by Silas Roads, Bucks county, Pa.; 1658, mortising machine, by J. A. Fay, Keene, N. H., and 1630, do., by Thomas Rogers, Philadelphia, Pa.; 1646, smiths' bellows, by G. W. Metz, Philadelphia, and 1570, do., by M. S. Reeves, Philadelphia; 1653-4, wire work and machine Cards, by J. D. Sellers, and Sellers & Pennock, Philadelphia; 1660-1-2-3, agricultural implements, by E. Chandler, Philadelphia.

Hydraulic rams, and several pumps, by W. & B. Douglass, of Middletown, Conn., were not received in time for competition, having been unavoidably detained on the way. They all appear to be good articles. One of the rams was in operation during several days of the exhibition;—doing its work in a satisfactory manner.

XI.—*Stoves and Grates.*

The present exhibition is remarkable for the number of good cooking stoves and ranges which have been deposited. The competition in this business, within the last few years, has produced such great improvement both in the principle and form of cook stoves, that culinary operations are now rendered easy, in the use of either wood or coal.

The judges in this department report, that they consider the following named excellent stoves as fully equal in merit to those which have received first premiums at former exhibitions; but perceiving no marked superiority over some formerly exhibited, they decline making any award in favor of those deposited this year. In those mentioned below, the judges perceive so little difference in merit that they do not think themselves justified in making a preference; considering these all deserving of equal credit:

No. 1504, American hot air cook stove, by Low & Hicks, Troy, N. Y., deposited by North & Harrison, Philapelphia.

No. 1505, Fay's Eureka, cook stove, Troy, N. Y., deposited by North & Harrison, Philadelphia.

No. 1506, Washington air tight cook stove, Anthony Davy & Co., Troy, N. Y., deposited by North & Harrison, Philadelphia.

No. 1516, Pierce's American air tight cook stove, for wood or coal, by Johnson & Cox, Troy, N. Y., deposited by Cox & Boughton, Philadelphia.

Nos. 1508-9, Atwood's patent empire cook stove, by Atwood, Troy, N. Y., deposited by E. Fizell, Philadelphia.

No. 1641, Stewart's air tight summer and winter cook stove, by B. P. Stewart, Troy, N. Y., deposited by North & Harrison.

The following named are mentioned by the judges as being fully equal to those presented at former exhibitions by the same makers, who then received premiums :

No. 1629, Granger's brick oven cook stove, by W. P. Cresson, Philadelphia.

No. 1626, parlor cook stove, by W. P. Cresson, Philadelphia.

No. 1633, air tight cook stove, by Wager & Dater, Troy, N. Y., deposited by P. W. Baker, Philadelphia.

No. 1647, cook stove, by P. F. Hagar, Philadelphia.

The following are considered by the judges as excellent stoves, and worthy of creditable notice:

No. 1519, Thatcher's Union air tight cook stove, by John W. Henry, Philadelphia.

No. 1517, hot air cook stove, by F. W. Most, Philadelphia.

Also cook stoves by Mathieu & Doiseau, and by John B. Kohler, Philadelphia.

Of the cooking ranges, they report as follows :

No. 1624, portable cooking range, by Julius Fink, Philadelphia. This range maintains the credit of the maker, who received for it a first premium on a former occasion.

No. 1704, cooking range, by Jordan L. Mott, N. Y., deposited by Williams & Hinds, Philadelphia. This range also received a premium at the last exhibition.

No. 1534, patent cooking range, by J. Beebe & Co., N. Y., and No. 1617, an eight boiler range, by Lloyd & Feltwell, Philadelphia, are also creditable articles.

Among the warm-air furnaces, for heating buildings, the judges notice:—

No. 1533, Fox's patent warm air furnace, by James Beebe & Co., N. Y., deposited by Peters & Co. This furnace is deemed worthy of a Second Premium.

No. 1655, hot air furnace, by David Culver, N. Y., deposited by C. & J. W. Clothier, Philadelphia. To this is adjudged a Third Premium.

A great variety of stoves for burning wood are exhibited. Among those of cast-iron, the most creditable for design and casting are,

No. 1639, Charles I. air tight parlor stove, by Ransom & Co., Albany, N. Y., deposited by North & Harrison.

No 1530, Stanley's parlor air tight stoves, by Warnick, Leibrandt & Co., Philadelphia.

The following air tight stoves of sheet-iron, for burning wood, are noted as worthy of commendation:—

No. 1507, Sexton's patent parlor wood stove, deposited by North & Harrison, and by Williams & Hinds.

No. 1671, several stoves, some with cast-iron bases, by F. Fœring & Co., Philadelphia.

A number of very creditable radiators are deposited by Fœring & Co., J. B. Kohler, H. G. Bartle, S. Kirby, and others.

No. 1640, a ventilating parlor coal stove, by J. McGregor, N. Y., deposited by North & Harrison. An excellent stove, in the form of air tight wood stoves, and in the use of which, a saving of coal will doubtless result.

No. 1515, air tight parlor stove for coal, by A. T. Dunham, Troy, N. Y., deposited by Cox & Boughton, Philadelphia. A cast-iron stove, with radiating flues; a very serviceable and good stove.

Nos. 1674–5, coal grate and port mantel, by Lloyd & Co., Philadelphia, are pretty designs, and of creditable workmanship; deemed worthy of a Second Premium.

No. 1725, French cook stove, by John McGuigan, Philadelphia. Made of tin, and intended for summer use—it appears to be admirably adapted for cooking with a very small quantity of charcoal.

No. 1637, a lot of fire bricks and cylinders for stoves, by H. Mann, Philadelphia. These appear to be excellent articles, and are worthy of creditable notice.

XII.—*Cabinet Ware and Furniture.*

It has been a subject of regret, at former exhibitions, that the display of cabinet ware was so limited, both in extent and variety; and this is the case, even in an increased degree, on the present occasion. It seems singular that, in Philadelphia, where such a quantity of furniture is made, of every variety—both of the rich and costly as well as of the plain and serviceable, that the judges in this department should be called only to examine a few chairs, window blinds, and miscellaneous articles, to the amount of only about two dozen! The Committee are so fully impressed with this consideration, that they feel it their duty to suggest the propriety of increased exertion for the promotion of future exhibitions of this branch of productive industry. They believe that the means are ample, and only require proper efforts to bring them into view.

In this department, a First Premium is awarded to No. 1254, glass paper, made at the Eagle Works, Baltimore, and deposited by Oliver Evans, Philadelphia. This article is made of unmixed glass, put on in the best manner, and adhering with unusual pertinacity.

Each of the following is deemed worthy of a Second Premium:—

No. 400, buffalo hide glue, by Charles Cummings, Philadelphia. Remarkable for its fine quality.

No. 1267, fancy chairs, by Wm. Sanderson, Philadelphia.

No. 1329, a secretary book case, by Richard Mitchell, Newport, Bucks county, Pa. This article is considered to merit this award in encouragement of the efforts of the maker.

No. 1350, a marble-top table and chairs, by Quantin & Lutz, Philadelphia. The handsomest articles of the kind in the exhibition.

Third Premiums to the succeeding:

No. 1224, reed window blinds, by Martin Free, Philadelphia. Well prepared articles.

No. 1268, venitian blinds, by G. W. Zimmerman, Philadelphia.

No. 1289, furniture knobs, by Latting & Hanburger, Philadelphia.

No. 1301, fancy and invalid chairs, by A. McDonough, Philadelphia. Exhibiting his usual good work.

The following are considered as deserving of approbatory notice:—

No. 399, curled hair, by Charles Cummings, Philadelphia; of fine quality.

No. 911, sacking bottoms and awning wing, by Fox & Wagner, Philadelphia.

No. 922, sacking bottom, by J. H. Foster, Philadelphia.

No. 1290, venitian blinds, by L. Kunitz, Philadelphia. Well made articles.

No. 1315, hair spring mattrass, by E. Foliot, Philadelphia. This is a good article, and deserves commendation. It is hoped that further improvement will be made in the manufacture of these desirable domestic conveniences.

No. 1330, a patent fan rocking chair, by Charles Horst, New Orleans, deposited by C. Gerke. An ingenious contrivance.

XIII.—*Musical Instruments.*

The number of pianos deposited was very large, and the judges on musical instruments devoted much time and labor to a careful examination of their respective qualities. In their report, they state that they were particularly embarrassed in their trials of the pianos, on account of the difference of pitch to which they were tuned, amounting, in some instances, to a full semi-tone—sufficient, where qualities approximated, to make it doubtful what might be the respective merits of tone if the pitch were identical. They suggest, as a remedy, that, in future exhibitions, no piano should be received for competition, unless tuned to a high concert pitch; by which, much of this trouble might be avoided.

Of the pianos in the present exhibition, the judges state, generally, that a majority of them, by six different manufacturers in this and other cities, have positive merits; showing progress in the art of construction. Except, however, in one instance, which will be hereafter mentioned, no novelty or improvement was observed of so distinct and important a character as to justify special commendation. In judging the pianos, results rather than means have been regarded; conceiving the best palpable tests of a musical instrument to be its musical capabilities: not its originality, its mechanical ingenuity, or that elegance of finish which affects neither the action nor the tone, and is designed to please the eye, not to satisfy the ear.

The judges, after devoting ten hours to examinations and comparative trials of the pianos exhibited, were unable to agree unanimously in a preference for any one. A seven octave square piano, No. 1276, made by Conrad Meyer, seeming, from the first examinations of the instruments in the positions in which they were placed in the room, to be superior, was moved by the judges and placed side by side, successively, with the pianos of every other maker; and this comparison resulted in a decision, by a majority of the judges, that this is the best square piano in the exhibition. The ground of this decision was the general excellence of the piano, and especially its power and brilliancy. The judges recommend, and the committee award, in this case, a Third Premium.

For the second best square piano in the exhibition, No. 1291, by Schomacker & Co., a Third Premium is also awarded for the general excellence of the instrument, and especially for the agreeable character and purity of the tone.

A grand piano, by Schomacker & Co., receives the commendation of the judges as an excellent instrument; the bass and the highest octave having a volume and clearness as the qualities of the tone. A "detached sounding board" and a metal "sounding box" were pointed out to the judges, as improvements in Schomacker & Co.'s instruments. The sounding box appeared to add to the power of the strings to which it is attached. The sounding board, as an improvement, has been referred to the committee of the Institute on science and the arts, who have reported favorably upon its merits.

The judges desire it to be distinctly understood, that in the recommendations of awards above made, their decision was the result of very careful examination; and in singling out the pianos of two makers, as superior to others, they do so with the declaration that several other manufacturers have instruments deposited, which are altogether creditable to their skill, and respectively notable for some peculiar merit.

Two chamber organs are exhibited; one of which, No. 1264, by Corrie & Brady, is very complete for its size,—combining most of the qualities of a large church organ. For this a Third Premium is awarded.

No. 1223, a chamber organ, by Joseph Buffington, is commended for the "barrel attachment."

No. 1302, a case of flutes, by Pfaff, and No. 1249, another by Weygandt, are most creditable specimens of workmanship. Both these makers have received premiums at former exhibitions.

No. 1259, a valve trumpet and trombone, by G. Zoebish & Son, Nazareth, Pennsylvania, are considered worthy of a First Premium.

XIV.—*Glass, China, &c.*

The assortment of glass in this, as in several previous exhibitions, gives evidence that the importance of the art has called to its aid such talents and perseverance as continue its advancement. It is to be regretted that no china ware is exhibited;—and in earthenware the samples deposited fall short of a fair representation of the present condition of the art in this country.

No. 605, glass ware, by the New England Glass Company, Boston, Mass., deposited by Muzzey & Monroe, Philadelphia. In the display made by this company, we discern a new and beautiful feature.

They have succeeded admirably in producing beautiful tints of purple and blue, distributed on the surface of the flint glass, without mingling; so that it may be cut or engraved distinct in each color;—the edges of the cutting being smooth, and the finish complete. For the colored glass, in the exceeding delicacy and uniformity of its tints, a First Premium is awarded. Of the pressed and cut flint glass, the judges remark that it is equal to any heretofore exhibited by this company.

No. 604, a lot of glass, by the Boston & Sandwich Glass Company, Boston, Mass., deposited by Muzzey & Munroe. This company has received the First Premium at former exhibitions, and the quality and variety of their present deposit fully sustains their well established reputation for excellence in the various branches of their manufacture.

No. 638, glass ware, by the Union Glass Works, Kensington, deposited by Hartell & Lancaster, Philadelphia. This also presents something new. The articles, consisting chiefly of cologne and toilet bottles,—opal, turquoise, enamelled, green, chameleon, &c., were made in an open or hollow ware furnace, of bottle glass. Many of the tints are as rich as would be expected in flint glass, while the invoice price of the ware is so low that it must secure a constant demand. The hock, cologne, and toilet bottles, of colored opaque body, are considered as deserving a First Premium. The mineral water bottles in this collection are good.

No. 656, green glass ware, by Benners, Smith & Campbell, Dyottville. This is an assortment of carboys, demijohns, porter and mineral water bottles, &c. The demijohns are particularly well made, and worthy of a Second Premium.

No. 682, green glass ware, by Joel Bodine & Son, Williamstown, N. J., deposited by L. Voigt, Philadelphia. Mineral water and porter bottles, equal to any in the exhibition.

No. 651, Rockingham ware, by Harker & Taylor, East Liverpool, Ohio, deposited by A. C. Hyer, Philadelphia. If this ware maintains its quality in the variety usually made, as in the samples submitted, the manufacturer deserves substantial encouragement.

No. 723, goblets and finger dishes, by the Albany Glass & Porcelain Company, deposited by Curtis & Hand. Colored glass, tinged throughout the mass,—and a fair article. The makers are recommended to apply to the committee on science and the arts, for a further examination.

A number of samples of stained glass for windows were deposited; but of these much of the material and work is foreign. No. 686, by Jones & Sawtell, is said to be wholly American manufacture. No. 1241, by John Gibson, is highly creditable for artistical design. To each of these a Third Premium. The judges look with confidence to a great improvement in stained glass at an early period.

XV.—*Books and Stationery.*

The judges appointed to examine the articles in this department, report, in substance, as follows:

No. 51, book-binders' dies, by Gaskill & Copper, Philadelphia. The most perfect specimens of this kind of work ever exhibited, and worthy of a First Premium.

No. 105, book-binding, by J. B. Lippincott & Co., Philadelphia. Quarto Bibles and Books of Common Prayer, in very superior velvet binding, showing many decided improvements upon any thing the judges have seen. In style of finish, excellence of work and materials, in the manner of fitting the clasps,—the superiority of edge gilding, in the joints, &c., they are greatly in advance of any work heretofore seen by the judges. They are justly entitled to the First Premium.

No. 107, book-binding, by Joseph T. Altemus, Philadelphia. Creditable specimens of fine binding. The judges particularly notice a quarto copy of the "Floral Offering" as a beautiful specimen of fancy binding, and entitled to a Second Premium.

No. 45, samples of ink, by A. W. Harrison, Philadelphia. This article has been tried by one of the judges for two years, who finds it to be a very superior ink. It is deemed worthy of a Second Premium.

No. 121, patent inkstands, by J. B. Lippincott & Co. A decided and great improvement upon the inkstands heretofore made upon this principle. A Third Premium.

No. 104, plates for letter copying, by Geo. Burnham, Philadelphia. These plates were tried, and found to answer the purpose admirably. They deserve a Third Premium.

The judges also speak favorably of No. 22, ruling pens, by W. O. Hickok, Harrisburg, Pa., and No. 46, cases for jewelry and surgical instruments, by N. A. Simons & Co., Philadelphia.

XVI.—*Paper Hangings.*

It will doubtless surprise many to learn that at an exhibition of domestic manufactures, held in Philadelphia, a city celebrated for the quantity and excellence of the paper hangings made within it, not a single article of the kind was deposited. We would more willingly account for this by supposing that our enterprising manufacturers of this article are so fully engaged in the supply of orders from customers, that they have forgotten the exhibition,—than to attribute the neglect on their part to any want of zeal or disposition to encourage these displays of the progress of American skill and improvement in the useful arts.

XVII.—*Fine Arts.*

The collection of specimens under this head is not as extensive or as creditable to the taste and skill of the artists as could be desired, and the judges express a regret that the articles offered for exhibition do not give evidence of that progress which those who feel an interest in the advancement of the fine arts would desire to see. These general remarks apply to the collection as a whole:—there are, however, a few specimens of very deserving merit.

No. 1205 & 1206, drawings in India ink, by A. M. Wiggin and J. R. Whitney, pupils of the high school. These specimens are highly creditable to the young artists. We hope to see more specimens of this style of drawing in future exhibitions.

No. 1203, crayon drawings, by Francis Mitchell. Very handsome specimens. Of the drawings deposited by pupils of the high school, it may be generally remarked that they are very creditable to the school and to the teachers.

No. 1216, a tulip, in water colors, by Miss Taylor. A beautifully executed work.

No. 1217, transferred engravings, by Frederick Bourquin, Philad. These are highly meritorious: not for any new invention or discovery; but for the great neatness, beauty, and accuracy of execution. A Third Premium.

No. 1236, classic figures, by Edward Dufrene, Philadelphia. It is understood that these are models. If so, they are works of merit, and the artist should be encouraged. A Third Premium is awarded.

No. 1246, stucco work, by W. H. French. Chaste and beautiful designs, with workmanship of the best character.

No. 1226, crayon drawings, by M. Beaugureau. These, in manipulation and fine finish are very superior, though the drawing is somewhat stiff.

No. 1261, crayon drawings and paintings, by Ph. Beaugureau, a son of the above mentioned artist. His work has the same character of exquisite finish with that of his father. This promising young artist received a premium last year.

No. 1269, engraved portrait of Benjamin West, by Samuel Sartain. A work very creditable to a young artist.

No. 1299, "Tachygraphic Painting," by J. B. Hall, Cincinnati. This is claimed as a new invention; but until brought to a greater state of perfection than at present, it would be difficult for the judges to form an accurate estimate of its value as a discovery, or of the perfection to which it may be brought by the skill of the artist.

No. 1310, painting on porcelain, by M. Strasser, Philadelphia. Well executed specimens of this style of painting.

No. 1322, engraving on wood, by J. H. Brightly, Philadelphia. This shows great boldness and skill in execution, and for so large a work is very superior. It merits a Third Premium.

No. 1244, ornamental penmanship, by W. J. Canby, Philadelphia. This the judges consider as the best writing exhibited.—Next in order they rank that by George Stimpson of Boston, which has the merit of great freedom and boldness of execution. Specimens by W. P. M. Ross were not received in time.

Daguerreotypes.—In this department there are some very excellent specimens in the exhibition, and the judges think they see a progressive improvement in this branch of art. They have not recommended an award in favor of any of the competitors; but are disposed to rank as first in order, the collection of McClees and Germon as containing the largest number of superior specimens. Next to these they place those by M. P. Simons,—which, however, are closely followed in excellence by those of M. A. Root. The collection of Langenheim is much smaller than at former exhibitions; but shows pieces of great merit.

Although the judges do not consider this department as strictly belonging to the Fine Arts, still good collections of specimens are attractive and add to the interest of our exhibitions.

XVIII.—*Jewelry and Silver Ware.*

The show of goods in this branch of manufacture is much smaller than on many former occasions. The judges appointed to decide on the comparative merits of articles deposited in this department, report that they have found nothing of peculiar excellence, exceeding what has been shown at former periods.

In the two cases deposited by Bailey & Co., Philadelphia, containing a variety of silver ware, the judges notice some samples of good hammering and fine chasing; the work being, in general, creditable to the makers, and sustaining the reputation formerly acquired. The bracelet and pin, No. 707, in the same collection, are beautiful specimens of that kind of work, and attract admiration by the brilliancy of the diamond, and the style and taste of the setting.

No. 685, a case by H. & W. Dubosq, Philadelphia, contains a great variety of small articles of silver ware, consisting of combs, card cases, hair pins, &c., which are creditable specimens of that kind of work.

No. 724, an assortment of gold pens, by Bard & Bro., of Boston and New York. These pens were carefully tried and examined: they are well finished, and are pronounced by experienced writers to be excellent for use. They deserve a Third Premium.

XIX.—*Marble Work.*

The place allotted to this branch of mechanical industry has, in more than one of our latter exhibitions, shown a very limited assortment; nor is the display of the present year by any means so varied and extensive as might be expected in a city where so large an amount of excellent work of this kind is produced.

No. 1501, a marble table, by Michael Casey, Harrisburg, Pa. This is made from a "conglomerate marble" found in Lancaster county, similar to the Potomac marble. It is a good specimen, but a higher polish is required to make it desirable as a material for furniture.

No. 1590, marble work, by Thomas Hargrave, Philadelphia. A monumental base and die, on which reclines the figure of an infant, in a sleeping posture. The workmanship on base and die is well done. The infant, being the work of an artist, should have been referred to the judges upon fine arts. Two lambs, by the same artist, should have had the same reference. In the same lot is a head stone, of Italian marble, with a carved wreath of flowers, enclosing a name in raised letters. The carving is tolerably well executed—the lettering is not so good.

No. 1742, three marble mantels, by John Eckstein, Philadelphia.

Of the white Italian marble mantel, of the style of Louis XIV, the judges remark that they have seen mantels of this style in a neighboring city, much more costly and of somewhat higher finish; but consider the present a creditable piece of work, for the skill shown in its execution, and the expense incurred in getting it up. The black and gold Italian marble mantel is of good material and workmanship.

XX.—*Hats and Caps.*

From the enterprize and spirit recently manifested by the manufacturers and dealers in this branch of business, a much more extensive exhibition of hats and caps was anticipated than that which actually appeared. The judges express their regret at this apparent apathy of those in the trade from whom more was expected; a number of whom have heretofore merited and received the awards of the Institute; thus profiting by their attention to former exhibitions.

No. 926, men's and boys' caps, by W. P. Erhardt, Philadelphia. Well and neatly made. One of these caps deserves some notice on account of its convenience. One side is of cloth, and the other of oiled silk, and either can be worn outside at the pleasure of the wearer. This, so far as the judges know, is the first instance of such an arrangement applied to caps.

No. 1000, hats and caps, by Samuel Hudson, Philadelphia. Well made and creditable to the manufacturer. One silk hat, in particular, for Friends' wear, is adjudged worthy of a Third Premium.

No. 1026, hats, caps, and furs, by T. B. Florence, Philadelphia. Creditable for their variety and good make. One silk hat in this assortment, from its excellence in all respects, is considered to deserve a Third Premium.

No. 1036, two silk hats by Evan Morris, Philadelphia. These hats, in the opinion of the judges, are entitled to much consideration from their perfection in make, style, neatness of finish, trimming, &c. They are indeed of superior workmanship, and Mr. Morris being an actual *manufacturer* of hats, is entitled to the First Premium.

No. 1035, one silk hat, deposited by A. H. Titus. The judges suppose this to be either the production of a very young apprentice to the business, or deposited for the purpose of obtaining free admission to the rooms. It has been worn, and is destitute of merit in all respects.

The hats by Charles Bulkley, E. S. Williams, Geo. Babe, B. Stratton, and Foster & Gebhard, are all creditable to them as manufacturers.

The furs deposited by John Davis, Samuel Louis, Solis & Brother, and by Thomas B. Florence, are beautiful specimens of productions in this line. Those of Mr. Davis are thought to be rather superior in workmanship, but the judges feel much delicacy on this point, all being so well put together.

XXI.—*Combs and Brushes.*

The collection of goods in this department of the exhibition is extensive in quantity and variety, embracing many articles of superior quality. We are gratified to perceive among them tooth brushes—an article, in the importation of which, large sums of money have been heretofore expended. From the report of the judges appointed to examine the articles under this head, we compile the following:—

No. 1046, brushes, by Abel & Bicknell, Philadelphia. For superiority and perfection of workmanship, and for beauty of style and pattern, these are considered worthy of a First Premium.

No. 934, brushes, by the male pupils of the Pennsylvania Institution for the Blind. These merit honorable distinction for excellence of workmanship, considering the circumstances under which they were manufactured.

No. 1003, shell combs, by Septimus Winner, Philadelphia. Remarkably excellent; distinguished for their workmanship, and for beauty and variety of style and pattern. They merit a First Premium.

No. 904, fancy combs, by Wm. Redheffer, Philadelphia. For perfection of workmanship, and for beauty and style of pattern, considered deserving of a Second Premium.

No. 919, combs, by Thomas Simpson, Philadelphia. A variety of well finished and creditable articles. Worthy of favorable notice.

An assortment of excellent brushes, by Edward Clinton, Philadelphia, was not received in time for competition.

XXII.—*Coach Work.*

Our enterprising carriage builders have, this year, graced this department of the exhibition with an assortment of vehicles which is not only highly honorable to the trade, but has also been a source of gratification to the public, as one of the most attractive features of the exhibition. On very few former occasions has so much elegant and substantial work in this line been exhibited.

After careful examination and consideration, the judges in this branch have recommended First Premiums to the following:–

No. 1579, a French phæton, by Wm. Dunlap, Philadelphia. For symmetry, good workmanship, and fine finish.

No. 1713, a Clarence coach, by Williams Ogle, Philadelphia. For good workmanship and elegance of finish. Mr. Ogle, being a member of the Board of Managers of the Institute, is prohibited, on this account, from receiving a premium.

No. 1594, York wagon, by Joseph Ruch, Philadelphia. For excellent workmanship and tasteful finish.

No. 1614, Columbian fire engine, No. 14, New York, by John Agnew, Philadelphia. For superior workmanship, elegance of painting, and general finish.

No. 1549, Northern Liberty hose carriage, by John Agnew, Philadelphia. For symmetry, good workmanship, and elegant finish. These two premiums, recommended for Mr. Agnew, cannot be granted, according to a rule of the Institute, which forbids an award to any member of the Board of Managers.

No. 1510, a brewer's dray, by William Snyder, Philadelphia. For strength and superior workmanship.

No. 1550, a cart for weighing coal, or other loads, by J. A. Stewart, Philadelphia. A very ingenious affair, and of excellent workmanship.

And a Second Premium to Robert B. Scott, of Philadelphia, for a cart, of very substantial and good material and workmanship.

The judges notice No. 1740, four carriages, by Geo. W. Watson, Philadelphia, as very tasteful, and of excellent workmanship; equal to those formerly exhibited by him.

Also, a York wagon, by W. Dunlap, and a light wagon, by Williams Ogle—both considered very creditable articles.

XXIII.—*Leather and Morocco.*

The judges appointed to examine these articles recommend a Second Premium to each of the following:

No. 330, Spanish hide sole leather by Francis Shriver, Westminster, Maryland, deposited by A. Ruth, Philadelphia. A superior article,—well tanned and remarkable for its solidity in the shoulders and offal parts. Though not much superior to that exhibited by the same manufacturer last year, he continues to excel.

No. 319, calf-skins, by Fell & Kinsler, Philadelphia, and No. 355, calf-skins, by H. M. Crawford, Philadelphia. These two lots attracted the particular attention of the judges, and were pronounced equal to any imported; though not much superior to specimens at last year's exhibition. They are elegantly soft, smooth, black, and glossy,—and not easily rumpled.

Third Premiums to the two following:

No 309, slaughter sole leather, by R. T. Downing, Monroe county, Pennsylvania, deposited by E. Levick & Co., Philadelphia. Well tanned and solid;—having all the characteristics of superior leather.

No. 356, calf-skins, by Samuel Miller of Berks county, Pennsylvania, deposited by J. T. Kirkpatrick & Co., Philadelphia. These, though somewhat deficient in finish, the judges believe to be well tanned; and for the tanning the premium is awarded.

Concerning No. 302, slaughter sole leather, by Charles B. Williams, and No. 303, the same, by W. H. Crawford, the judges remark that they perceive no difference,—nor any improvement over last year;—though they consider both lots highly creditable for the general quality of the leather, and worthy of favorable notice.

No. 373, South American kid, by G. & H. Moore, Philadelphia: worthy of notice, being black, soft, smooth, and glossy.

The enamelled leather, by Pugh, and also that by Levick & Co., is considered creditable; but not superior to some offered at former exhibitions.

XXIV.—*Boots and Shoes.*

In this department, the assortment of boots and shoes for men's wear is highly creditable to the manufacturers, and though there is no particular improvement in make or style to warrant an extended notice, yet the general excellence of the articles exhibited manifests a continued progress in the craft. The judges notice with satisfaction the increased use of steel shanks, and recommend them as being calculated to preserve the form of the boot, and to insure ease and comfort to the wearer.

The meagre exhibition of ladies' boots and shoes, in a city so celebrated for excellence in this branch as Philadelphia, can only be accounted for by the fact that our manufacturers have been unable to supply the demand for the fall trade, and have thus been compelled to neglect the exhibition of the Institute.

Third Premiums are awarded as follow:

No. 378, boots and patent Downings, by Caspar Benkert. In workmanship the boots excel all others in the exhibition; while the style and general excellence is very superior. The same remarks will apply to the patent Downings.

No. 394, boots of various patterns, by Leonard Benkert;—all of excellent quality. The patent Downings are a beautiful article.

No. 434, fine calf stitched and water-proof boots, by McCurdy & O'Reilly. Excellent in point of taste and elaborate finish,—and in general appearance beautiful.

The following receive commendable notice from the judges:

No. 316, calf and gaiter boots, by John Heumann. Excellent articles, of good quality and style.

No. 353, boots, by N. Haywood & Co., neat and substantial.

Nos. 382 and 395, spring shanks, by Jon. Russell, and by J. McGinley, a good article.

No. 385, men's lasts, by John Williden. General finish remarkably fine.

No. 427, boot and shoe expanders, by Geo. Kemp. An admirable article.

No. 436, boots, overshoes, and gaiters, by Andrew Vetter. Neat and good.

No. 438, clogs for walking on ice, by J. Powell. The best article for genteel wear that has been seen by the judges.

No. 440, ladies' slippers, and lasts for French shoes, by Wm. Meyers. Good articles.

Gunning and hunting shoes, of good design and make, by J. Powell, were not entered in time for competition. They might have received a premium, if brought earlier.

XXV.—*Chemicals.*

The display of chemicals is this year much finer, as regards quantity, variety, and excellence, than in any former exhibition; and the thanks of the Institute are due to the depositors generally, for the beauty and excellence of their preparations. The following is a summary of the report presented by the judges appointed to examine the chemical articles in this exhibition.

First Premiums are awarded as follows:

To No. 332, a very fine and large lot of crystals of yellow prussiate of potash by H. W. Worthington, Philadelphia. The abundance of the specimens testifies to the extensive scale upon which the manufacture is conducted, while the large and well defined crystals manifest its purity.

No. 384, red prussiate of potash, by Carter & Scattergood, Phila., of very superior quality, and in excellent crystals. On account of the excellence of the preparation and the importance of the article, the Premium is awarded.

No. 375, chemicals, by Farr, Powers, & Weightman, Phila. This lot is very large, and of a very high order of excellence,—surpassing any other in the exhibition. The following articles have been carefully compared by the judges with all others exhibited, and pronounced to be the best: precipitated carbonate of iron; tannin; salt of tartar; corrosive sublimate; piperine; sulphate of quinine; white and red precipitates; tartrate of iron and potash; nitrate of silver; and sulphuret of potassium. The following are of very superior quality, but are the only specimens of the kind in the exhibition: morphia; hyposulphite of soda; vermilion; muriate of tin; calomel; citrate of potassa; acetate of morphia. The other organic preparations are also of very excellent quality. In one or two of the preparations they are, however, surpassed by Wetherill & Bro. (312,) and by Smith & Hodgson, (430.) Considering that at every exhibition of the Institute, for some years, the excellence of the preparations by Farr, Powers, & Weightman has entitled them to the First Premium;—considering also the great extent and vast importance of their manufactures, the judges earnestly recommend to the Committee on Exhibitions to request the Institute to award to Farr, Powers, & Weightman a Gold Medal, as a testimony of the excellence, extent, and importance of their manufactures. Should this not be thought proper, the judges recommend for them the First Premium.

No. 430, chemicals, by Smith & Hodgson, Phila. A very excellent lot,—maintaining the high reputation which this firm has acquired. The judges notice, as particularly worthy of remark, oxide of chrome, lactate of iron, valerianate of zinc, chromic acid, sub-oxide of copper, gallic acid, tannin, and strychnia. The specimen of phosphate of iron, and the samples of acids, are the best in the exhibition. The First Premium is awarded for the general excellence of these articles.

To each of the two following, a Second Premium:

No. 312, chemicals, by Wetherill & Brothers, Phila., including many of very superior quality,—among which the judges notice particularly, the very beautiful crystals of tartar emetic, the sulphate of potassa, phosphate of ammonia, and citrate of iron, as being the best exhibited. The volatile oil of juniper is also very fine, while some other of the preparations cannot be considered as of the first quality.

No. 411 to 422, chemicals, by Harrison, Brothers & Co., Phila. A lot, of very handsome appearance. The crystalized sugar of lead is especially deserving of notice for the beauty of its color and crystalization. There is also a fine block of alum, from the crystalizing vat, weighing 500 pounds;—and a very fine specimen of green vitriol, which is the best in the exhibition. They also exhibit red and iron liquor, and pyroligueous acid, in which there is no competition.

A Third Premium to No. 306, iodide of lead, and deutiodide of mercury, by E. L. Smith & Brothers, Phila. These specimens are small; but the judges believe them to be the best of the kind in the exhibition. The cyanide of potassium has been less carefully prepared.

The judges remark that in recommending these premiums they have been guided by the following considerations:—1st, The purity of the preparation. 2nd, Its importance in the arts. 3rd, The scale upon which it is made.

Of many other articles, among which are the following, they speak in terms of commendation; No. 307, calcined magnesia, by James Burns; 308, deutiodide of mercury, by H. M. Troth; 318, do. and iodide of lead, by S. M. Bines; 325, compound extract of colocynth, by John Cotterell; 341, machine spread plaster, by C. Shivers; 377, crystals of yellow prussiate of potash, by J. L. Crew; 423–4, iodide of lead and oxalate of ammonia, by H. A. Guier.

Black writing ink, by Thomas; blue do., by Rogers; printing ink, by Thornton; snuff, by Demuth; and shoe blacking, by a number of different manufacturers, all appear to be good of their kind.

No. 322, a box of starch, by Altemus; and No. 389, pearl starch, by Colgate, are both good. The judges believe the latter to be the best.

No. 374, a specimen of proto-bromide of mercury, by Drs. Alter & Gillespie, of Pittsburg, made from the bromine obtained from the salt springs of that region, is a fair sample of the salt, and an interesting addition to the manufacturing wealth of our country.

No. 361, oxide of cobalt, of two different qualities;—and specimens of the solutions, by Coffin & Booth, Phila. This is believed to be the first successful attempt to refine cobalt in this country,—and the article is of such extensive use, especially in the manufacture of glass and porcelain, as to make the manufacture an important one. The article has not yet come into sufficiently general use to allow the judges to express an opinion of the purity of the preparation; but it deserves notice from its importance.

No. 410, mineral water, by E. Roussel, and No. 402, do., by W. Riddle. The judges, after examination, are satisfied of the great superiority of the first of these lots; and their judgment is the same in reference to the two winter drinks, nectar, by Roussel, and ambrosia, by Riddle,—which are compound syrups, dissolved in mineral water. Considering the well established superiority, which Roussel has for years maintained in the preparation of mineral water,—the immense amount of it which is made,—and the very great and beneficial influence which so pleasant and salutary a beverage must have upon the habits of the people, the judges deem No. 410 worthy the award of a First Premium.

No. 365, alcohol, deodorized, by E. Roussel. This specimen is of excellent quality, and is interesting in consequence of the result,—a high degree of concentration being obtained by a single operation, with no other agent than charcoal.

XXVI.—*Philosophical Apparatus.*

The assortment of philosophical apparatus is not large; but a number of the principal articles are characterized by great skill and ingenuity. It is to be regretted that the makers of this kind of work do not more generally exhibit, as it is confidently believed that not only the condition of their respective arts, but also their own interests, would be promoted by so doing.

No. 622, scales, weights, and measures, by F. Meyer & Co., Philadelphia. The makers deserve great commendation for the enterprize and skill evinced in the construction of the large balance, intended for the adjustment of standard county weights and measures. It is constructed, principally, after the late Mr. Hassler's arrangement; but is improved by a modification of the method of Mr. Peale, of the U. S. Mint, for causing the pans to be lifted always from the same points, when the beam is brought to rest on its knife-edge. For this balance, we award a First Premium. The standard weights and measures were exhibited last year—they are perfect copies of the U. S. standards, and leave nothing to be desired. The scales for grocers' and druggists' use are very neatly finished instruments.

No. 713, a "lightning exhauster," invented by J. D. Reid, of the Telegraph Office, Philadelphia. This is a very ingenious contrivance for obviating the destructive effect of atmospheric electricity on the electro-magnetic telegraph apparatus. For its ingenuity, neatness, and utility, we award a First Premium.

No. 621, slides for magic lanterns, by Henry S. Nolen, Philadelphia. Believed to surpass the European paintings of the same kind, in accuracy of design, and in clearness and delicacy of execution. A Second Premium.

No. 623, portable Daguerreotype apparatus, invented by A. C. Harrison, and deposited by Elliott & Gunn, Philadelphia. An ingenious and compact arrangement, exceedingly convenient for travelers, obviating the necessity of making a dark room at every place of operation. Deemed worthy of a Second Premium.

No. 668, single, double, and triple complex re-acting electro-magnetic machines, invented by Moses Chase, deposited by A. F. Porter, Philadelphia. In these, there is an ingenious contrivance, for moderating, at pleasure, the intensity of the shock, and also for directing the current to several parts of the body at the same time. A Second Premium.

No. 650, electro-magnetic machine, for producing motion, by D. Lippincott, Philadelphia. A very prettily contrived instrument, but not new. A Third Premium.

No. 687, electro-magnetic machines, by W. C. & J. Neff. Very creditable in point of finish.

No. 613, lightning rod points, by T. Armitage, have been referred to the Committee on Science and the Arts.

XXVII.—*Straw Goods.*

The deposit of goods in this line is very limited; but the Committee express a hope that, as straw bonnets and hats are now largely manufactured in this country, we shall, hereafter, see, in our exhibitions, a greater variety and more creditable samples of this branch of the mechanic arts.

No. 918, palm leaf hats, by Rice & Wasson, Boston, deposited by W. E. & J. G. Whelan, Philadelphia. These are purely of domestic manufacture, and fair specimens of their kind. The judges hope for more competition in future in these goods.

No. 936, Florence and pearl straw bonnets, by John T. Walton, Philadelphia. Of foreign material.

No. 965, "Chapeau Pamela" bonnets, by Mrs. Susan Kendall, New York. Deserving of attention for the purity of the stock, beauty of shape, and general finish. They merit a Third Premium.

XXVIII.—*Surgical Instruments and Dentistry.*

This department also contains but a meagre display, and the judges regret the paucity of appropriate objects for their examination and decision.

No. 640, an artificial leg, by Kretschmar & Gildea, Philadelphia. Very well made, and calculated to perform its duty with comfort to the wearer.

No. 639, by Dr. A. W. Patterson, and No. 700, by B. C. Everett, two varieties of trusses for hernia, both of which will be found excellent in appropriate cases; but neither being of universal adaptability.

No. 672, invalid spring bed, by B. Eastman. A good apparatus; but expensive and complicated.

No. 696, dental instruments, by Goodwin. Their merit consists in being made by the dentist himself.

No. 689, by Jones, White & Co., and No. 666, by C. T. Goodwin. Two machines for grinding artificial teeth, of which the first named is very good and well made.

A number of specimens of artificial teeth were exhibited by different depositors, of which the judges consider No. 696, by Goodwin, to be undoubtedly the best.

No. 697, natural teeth, plugged in the mouth, by Dr. Thomas W. Evans, Lancaster, Pa. This work is done in a superior manner, and by a new method. Dr. Evans, the operator and discoverer, presented to the judges abundant evidence of the truth of his statements, and of the excellence and novelty of his plan. Believing that his industry and ingenuity deserve a reward, he is adjudged a First Premium for his improvement in the art of plugging decayed teeth.

XXIX.—*Soaps and Perfumery.*

Of this department it may be remarked that the display greatly exceeds that of last year, although, in regard to the number of contributors, it falls short of some previous exhibitions. It is a subject of regret that the soaps, oils, &c., used in common life, and for domestic purposes, are so sparingly offered to the public eye at our exhibitions; when we know that they are manufactured extensively among us,—

and that their quality will compare favorably with the same kind of article of European make.

The following is an abstract from the report of the judges:

No. 363, a large block of palm soap, and small cakes of soap, by J. R. Graves. Of good quality and color,—free from excess of alkali,—and fully equal to specimens formerly exhibited.

No. 390, pale soap, by W. Colgate & Co., N. Y., deposited by M. Clark, Phila. Of excellent quality compared with ordinary common soaps,—and of superior color.

No. 331, sperm candles, cake spermaceti, and oil in jars, by B. B. Myrick, Phila. The spermaceti, both in mass and in candles, is very superior. It is of a pure white color, and very free from oil, which, together with its marked crystaline structure, indicate great purity. The whale oils are well bleached and very clear; the sperm oil, a fair color.

No. 435, a large lot of perfumery and fancy soaps, by Thomas Worsley, Phila. In this assortment are many creditable articles, both in quality of goods and in the style of putting them up. For the fancy soaps he is awarded a Second Premium.

No. 365, a large and tastefully arranged display of perfumery and fancy soaps, by E. Roussel, Phila. The present exhibit by this manufacturer, not only equals those of previous years, but, if possible, surpasses them. Among the more striking articles are busts of Washington and Franklin, modelled of pure white soap, resembling Carrara marble; and national columns of white and colored soaps, with appropriate devices, ingeniously and tastefully executed. The shaving cream, almond and rose soaps, and perfumed extracts maintain their unsurpassed excellence. In consideration of the superior excellence of the articles exhibited on the present occasion, a First Premium is awarded.

No. 747, a dentifrice, by J. A. Wadsworth, Providence, R. I. The style in which this article is put up cannot be too highly commended, and the judges would make an award for the display; but this being an article liable to produce a medicinal effect, with the composition of which they are unacquainted, they cannot consistently do so. They remark, however, that it possesses the external qualities which are desirable in a dentifrice.

XXX.—*Gum Elastic Goods.*

In the department of Caoutchouc goods there is this year a deficiency in quantity, and from a view of the deposits the inference would be that this branch of manufacture was on the decline. Not only, however, is the contrary known to be the case; but it is also known that in this department of art our country surpasses Europe. The present meagre exhibition of this kind of goods is the more to be regretted, as it was fully understood that a large assortment of interesting and useful articles was to have been presented.

No. 342, India rubber coat; Nos. 346–7, long gloves and mitts, by the Naugatuck Company, Conn. Nos. 343–4, Poncho, and air tight traveling bag, by Wm. Rider & Brother, Harlem, New York.

Nos. 345–8–9 and 50, life preserver, and India rubber maps, by Goodyear & Ely, New York, with other goods by different makers—all deposited by Wm. G. Steel, Phila. This assortment, generally, sustains the high character which these goods have acquired. The long gloves and mitts, with the coat, Poncho, and traveling bag, are noticed by the judges as superior. The smooth black surface of the gloves and mitts, without the intervention of a cracking varnish, deserves much praise. For this decided improvement in the surface and finish of India rubber goods, as exhibited by the gloves an mitts, we award a Third Premium.

No. 362, a case containing India rubber shoes, deposited by H. Tilden, not being open, the judges were unable to examine the goods.

No. 1555, hemp hose, by Amasa Stone, is an excellent article.

XXXI.—*Copper, Brass, and Plumber's Work.*

The judges appointed to examine articles of this kind, notice as follows:

No. 1723, a chime of eleven large bells, made for St. Philip's Church, Charleston, S. C., by T. J. Dyre, Jr., Phila. These bells are remarkable for the excellence of the casting, and being brought in just as they were taken from the mould, they have not yet been tuned; but competent judges of the tone think the moulder has been very successful in making each bell so near the proper note. Believing this to be the first chime of large bells ever made in Philadelphia, and considering also the beauty of the workmanship, we award to the maker a First Premium.

No. 1701, brass castings, by J. H. Miller, Philadelphia; figures and ornamental work, very neatly executed.

No. 1688, copper rivets and burs, for making hose, by J. & D. Sellers, Phila.; a very good article.

XXXII.—*Tin Work.*

The number of depositors in this line is this year somewhat increased; but still falls far short of what might be expected in a city where so much excellent tin work is made.

No. 1568, tin ware and domestic utensils, by Isaac S. Williams, Phila. This work is well done, and equal, if not superior, to former specimens by this well known manufacturer. The judges have recommended a Third Premium; but Mr. Williams being a member of the Board of Managers, a rule of the Institute forbids the award.

No. 1689, planished and japanned tin ware, by Thomas Butler, Phila. Well made work. The dish covers deserve particular notice; and the assortment is considered worthy of a Third Premium.

The judges observe concerning both these lots of tin ware, that they cannot, at present, see how work can be better made, unless by an improvement in the handles and feet of the different articles, which do not correspond with the excellence of the other work. They also suggest that some experiments should be made in order to improve the polish of tin ware,—believing this to be possible.

XXXIII.—*Paints and Colors.*

The assortment of articles deposited under this head at the present exhibition, is highly creditable to the manufacturers. The following notices are extracted from the report of the judges entrusted with the duty of examining this department.

No.—Chrome yellow, white lead, orange mineral, and red lead, by Wetherill & Brothers, Phila. The chrome yellow is of excellent quality, and equal to the best imported. The red lead is superior in tone of color to any exhibited, and worthy of the First Premium. The orange mineral is very good, but not as fine in orange color as some exhibited.

Nos. 415 to 419, white lead, dry, and ground in oil; red lead; litharge; and orange mineral, by Harrison, Brothers, & Co., Phila. All of good quality. The orange mineral, on account of its brilliant color, is worthy of the Second Premium. The litharge also deserves a Second Premium.

No. 431, white lead, red lead, and litharge, by Cuthbert & Wetherill, Phila. The red lead in this lot is worthy of a Second Premium, and the litharge of a Third Premium.

Nos. 379 and 380, white lead, dry, and ground in oil, by R. & J. Wharton, Phila. Both of beautiful quality.

The judges remark, that upon examining the specimens of white lead by Wetherill & Brothers, Harrison, Brothers, & Co., Cuthbert & Wetherill, and R. & J. Wharton, they find all excellent in quality, and quite equal to the best of English manufacture;—without material difference enough to give a preference in favor of any of these depositors.

No. 409, black graphite paint, by J. Weisman, Phila. An excellent article for painting iron work, tin roofing, &c.

No. 432, varnishes, by C. Schrack, Phila. These appear to deserve the well earned reputation which they have for a long time sustained in the market. No. 437, steam putty, by the same maker;—of excellent quality.

XXXIV.—*Fancy Goods.*

In this extensive and varied department, the judges perceive but little difference from the exhibitions of the past two or three years. As usual, many tasteful and well-made articles are on the list referred to them; while a great many others are not distinguished by any merit, ther in the design or workmanship.

No. 913, military ornaments, by Pinchin, are very good, and fully equal to those for which he received a premium last year.

No. 920, bead bags and purses, by L. E. Massey. Workmanship and designs very superior, and the articles equal to any imported. They are judged worthy of a First Premium.

No. 930, fancy feathers, by Mrs. Griffith. Beautiful and well made. The maker received a premium at a former exhibition.

No. 933, articles made by the female pupils of the Pennsylvania Institution for the Blind. Admirable, considering by whom executed.

A Second Premium is awarded to the pupils, generally—and to Miss Cruser, a blind pupil, for a bead vase, containing flowers, a Third Premium.

No. 947, baby jumpers, cradle, and elastic swing, by J. T. Townsend. These display much taste in the design, improvements, and finish; and are very well made and useful articles, highly creditable to the maker, who is the only depositor of articles of this kind.

No. 949, hair work, by F. J. Dressler. Very beautifully executed, and worthy of a Second Premium.

No. 974, artificial flowers, by J. D. Brown. These the judges consider as the best American flowers made; many of them are equal to the French. The present specimens sustain the well deserved reputation of the manufacturer, who received a first premium for the same kind of goods on a former occasion.

No. 986, a case of wigs, by L. Cabale. Excellent and well made articles.

No. 1024, wigs, hair brushes, and craniometer, by Bogue & Fawcett. The hair work is tastefully and well made. The "ventilating wig" appears to be well calculated for coolness and pleasantness of wear, as well as durability. The craniometer is apparently a useful contrivance for measuring the head; but the judges profess to have little knowledge concerning its use.

No. 1028, Odd Fellows' regalia, by J. W. & E. D. Stokes. Very well executed, but not superior to that shown at former exhibitions.

No. 1045, tinseling, by John Bezard. Deserving of notice for its good execution.

No. 1051, a large assortment of pickles, by T. B. Smith. Done up and displayed in his usual excellent style. The present deposit is considered fully equal to that for which he received a first premium on a former occasion.

No. 1052, bead bags and purses, by Mrs. C. S. Moore. Very well made indeed; but not considered equal to No. 920.

No. 938, artificial flowers, by E. Bright. Good; but not equal to No. 974.

No. 937, plumes, by Mrs. Mench. Deemed beautiful specimens by the ladies who assisted the judges in their examinations.

No. 1029, cleaned kid gloves and laces, by A. H. Cooper. The cleaning of these articles is performed on a patent machine, with the operations of which the judges are not acquainted. The work appears to be well done, and deserving of notice.

No. 962, cleaned gloves, by A. Moore. Of fair appearance.

XXXV.—*House-Keeping Articles.*

In this branch of the exhibition, the judges remark that there is but little competition, though the articles are generally well made, and of a useful character.

No. 1551, washing machines by Porter & Graeff; and 1621, washing machines, by Lukens. Similar to those deposited last year.

No, 1651, a mangling machine, by William Baylis, Philadelphia.

There is an improvement in this mangle over those made on the old plan. This is in the beam, by which the labor of the operator is lessened. We recommend this machine to public notice, and award to it a Second Premium.

No. 1607, wooden ware, by William Boyer, Philadelphia; consisting of tubs, safe, &c. Well made articles. Also, a nursery chair and basket; worthy of notice for neatness.

No. 1642, improved barrel churns, by Edward Spain, Philadelphia. For those excellent articles the maker received a premium last year.

No. 1512, flour, manufactured by Beaumont & Hollingsworth, Zanesville, Ohio, deposited by Ridgway & Budd, Philadelphia, and No. 1557, flour, by R. Richardson, Rochester, N. Y., deposited by Caleb Clothier, Philadelphia. Both these specimens of flour are of truly excellent quality—and the judges, after a thorough examination, were scarcely able to decide between them. A portion of the flour from each barrel was made into bread, by the same hand, and baked at the same time. The loaves were very similar in quality, but that made from the Ohio flour rather had the preference, being whiter, and lighter in texture than the other. No award is recommended, as neither of the specimens is considered superior to the Pennsylvania flour, which obtained a premium last year.

No. 1597, bread, by A. W. Wood, by J. G. Moxey, and by Joseph P. Whiting. All excellent, and creditable to the respective bakers by whom it was made. They all deserve encouragement.

XXXVI.—*Clothing and Needlework.*

In this varied and extensive department there are always many articles which require female taste and judgment, properly to estimate their merits. We have, therefore, in this, as in former exhibitions, both in this branch and that of house-keeping articles, asked and received the aid of a Committee of Ladies of acknowledged skill and taste in the matters referred to them. The industrious and attentive assiduity with which they fulfilled the duty of examining,—and the lucid and able reports which they returned as the result of their deliberations, are honorable to them and merit the thanks of the Institute.

They notice the general display of clothing and needlework as being fully equal to former exhibitions; and while they regret the expenditure of time and skill upon articles of comparatively little usefulness, they feel bound to note with admiration the many successful triumphs of the needle, in the numerous forms to which the labors of their countrywomen have been applied. For such productions as are distinguished by rare excellence, or by marked utility, they have recommended awards;—there are, however, many others which evince great industry and skill in the use of the needle, but which do not claim more than general praise.

No. 945, embroidery, by Mrs. Wickersham. Of elaborate design; evincing much taste and skill in the blending of colors and workmanship. A Second Premium.

No. 983, a lot of clothing, by Bennet & Co. Of handsome pattern and good workmanship;—worthy of a Second Premium.

To each of the following, a Third Premium is awarded:

No. 903, embroidered fire screen, by Miss Mary Dunton. Very beautiful in design and workmanship.

No. 1052, crochet work, by Mrs. C. S. Moore. Superior in richness and design.

No. 1038, fancy clothing and needlework, by A. Brewton. Beautiful specimens.

No. 1021, a rug, by Eliza Thomas: a very good imitation of woven rugs.

No. 915, knit baskets and bonnet, by Mrs. Butler: done with much ingenuity and taste.

No. 914, cotton knit bed spread, by Miss Sarah Reed: of beautiful pattern and neatly executed.

No. 957, Minerva shoulder brace, by Mrs. Boyce,—of improved pattern.

No. 916, shirts and stocks, by C. & E. Henszey: of good pattern and superior work.

No. 963, childrens' clothing, by Mrs. G. Edwards. Workmanship exceedingly beautiful:—patterns the most approved.

No. 1019, boys' clothing, by Wm. B. Taylor: needlework good, and pattern excellent.

Of the following the judges speak in terms of praise, but have not recommended premiums:

No. 1031, fluting, plaiting and goffering, by Madame Juery: very beautifully done,—and premium granted last year.

No. 906, wrappers, shirts, and stocks, by C. A. Walborn: in the accustomed excellent style of this well known manufacturer. The work is well executed,—and the wrappers and badges rich and tasteful.

No. 941, embroidery, by Wilhelmina Schomacker; 964, bonnets, by E. & J. Brown; 1242, needlework, by Miss M. E. Smith; 973, caps and head dresses, by H. G. Suplee; 978, table cover and embroidered tray, by Mrs. A. Schieferdecker; 998, shirts and cravat ties, by G. W. Ward; 1007, caps and head dresses, by Mrs. Dufrene; 1014, head dresses, by Mrs. Mc. Donough; 1027, lace knitting, by Mrs. Catlin; 1043, ladies silk coat, by Mary Edwards. These, with a number of other articles, are commended by the judges for neatness of workmanship, tastefulness of design, and general merit of execution.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on U. S. Government Steamer "Virginia."

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, who, agreeably to request, witnessed, by sub-committee, the experiments tried on the Delaware river with the U. S. Government Steamer "Virginia," REPORT:—

That they understand that the hull of this vessel was built by Wm. H. Brown of New York, and that her dimensions are as follows:—Length on deck, 147 feet 6 inches; breadth, 24 feet 3 inches; depth, 15 feet 10 inches; tonnage, $403\frac{22}{95}$ tons; draught of water, 7 feet forward, and 7 feet 6 inches aft. She was formerly propelled by two paddle wheels, of Aldrich's patent, similar to the "Hunter submerged wheel," but working vertically. The external diameter of these wheels was nine feet nine inches; each having 16 paddles of 20 by 14 inches. In place of these wheels, the "Virginia" has been recently furnished with two "Loper propellers," worked by the same engines which were used to drive the original paddle wheels. These propellers are each eight feet in diameter. The two engines have each 24 inch cylinders, and 30 inches stroke.

The Committee have no knowledge of the relative speed of this vessel when she was worked by the above mentioned paddle wheels, and are therefore unable to make a comparison between her former and her present performance. They can only state the result of their observations made on an experimental trip with the "Virginia," on the morning of the 11th September, 1847, after the paddle wheels had been removed, and the Loper propellers substituted.

Leaving the wharf, at Dock street, the vessel proceeded down the river, passing the south side of the large ship-house at the Navy Yard at 10 h. 20 m. 47 s., and being opposite the north side of the lower wharf at the Point House at 10 h. 34 m. 47 s.; which makes the time of passing this distance (2·19 miles by coast survey) exactly 14 minutes. Continuing her course, the vessel was opposite the flag-staff at Fort Mifflin at 11 h. 10 m. 50 s., giving a running time, from the Point to the Fort, of 36 m. 3 s.—or, from Navy Yard to Fort, 50 m. 3 s. The distance from the shears at the Navy Yard to Fort Mifflin is, by coast survey, 7·16 miles. During the downward passage, the engines worked very uniformly, making 54 revolutions per minute; it was made against tide, but with a moderate breeze in our favor.

Below the Fort, the experiment was tried of putting the vessel about, by stopping one of the propellers, and also by reversing its action. The first half turn, by which the course of the vessel was reversed, and her head brought so as to be directed up the river, on an exactly opposite course to that pursued immediately before being brought about, was accomplished in 4 m. 30 s., bringing her head round against a stiff breeze from the N. E. The next half turn, by which the head of the vessel was brought to her original course down the river, was made in exactly two minutes, by the action of the propellers alone. This experiment was repeated, and her head again directed up the river, in 3 m. 2 s.; while the next half turn, to bring her again upon the downward course, occupied 2 m. 14 s.

In returning up the river the tide was favorable, but the passage was made against a stiff breeze from the N. E. From the flag-staff at Fort Mifflin to the Point House wharf, the run was made in 29 m. 17 s., and from the Point House to the Navy Yard in 12 m. 20 s.—total time, from Fort to Navy Yard, 41 m. 30 s.; the engines making 50 revolutions per minute. The Committee had no means of ascertaining exactly, for themselves, the pressure of steam employed; but were informed that it was 60 pounds to the square inch.

By order of the Committee,

William Hamilton, Actuary.

Philadelphia, Nov. 11, 1847.

Report on J. H. Schomacker & Co.'s Pianos.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination an Improvement in Pianos, invented by Messrs. J. H. Schomacker & Co., of Philadelphia, Pennsylvania, Report:—

That they have examined the application to pianos of the inventions lately made and patented by J. H. Schomacker & Co., of which the following is a brief description:

The sounding-board, in these pianos, is constructed so as to be detached from the sides of the Instrument, resting on props, or supports, which are secured to the bottom of the case; one end of the sounding-board being made with a return, so that its whole length is virtually increased. This construction frees it entirely from the injuries which it would receive from changes in the form of the case caused by the strain of the strings, or from the usual shrinking and warping of the wood used in construction, and gives it the fullest opportunity to aid in the vibration consequent upon the sounding of the string.

The result of their examination, which has been carefully made, is, that Mr. Schomacker has, by his *detached sounding-board*, attained, in the tone of his pianos, a much greater degree of sonorousness and resonance than the Committee have before observed in other instruments of the kind. They are also of opinion that these pianos will be more durable than those made by the old principle, and that the inventor is deserving of much praise for introducing this improvement, which will doubtless accelerate the perfection which these instruments are gradually attaining.

With regard to the patent arrangement for candle-sticks, on the music-board, the Committee believe that it is a very convenient arrangement—no objections can now be raised as to the danger of their vibrating, as all the parts of contact are carefully and effectually lined with felting.

By order of the Committee,
William Hamilton, Actuary.
Philadelphia, Nov. 11, 1847.

Report on W. H. Jennison's Diaphragm Filter.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination the Diaphiagm Filter submitted by W. H. Jennison, of the city of New York, Report:—

That they have carefully examined and experimented on the three varieties of filters submitted to them. Their experiments have been conducted with great care and have extended over a duration of nearly 20 months.

No. 1. The first filter of Mr. Jennison is in the form of a hollow truncated cone, attached to a similar cone by its base, thus forming a double cone, at each end of which is a female screw adapted to the male screws on the nozzles of our common hydrants; within this is a double cone, attached at the place of junction to the external shell, and leaving a space between them varying in dimensions from a quarter of an inch to an inch. The internal cone is perforated with holes, to allow the passage of water and act as a colander. A conical cap of felt is attached, by its edge, to the ring forming the base of the interior vessel within which it plays loosely, and constitutes the filtering medium. The current of water passing through the upper colander is strained through the felt, leaving the coarser particles of sedimentary matter on its upper surface, and passes through the lower colander and nozzle into any vessel ready to receive it.

No. 2. The second filter contained, in lieu of the inner perforated double cone, two parallel circular plates of perforated metal, attached, at their edges, to the external shell, separated from each other, by a chamber filled with compressed sponge previously reduced to small fragments. The shape of the external shell also, in some specimens, approximated to a spheroid, having nozzles with screws, as in the filter No. 1.

No. 3. The third filter contained sharp pure sand, exceedingly compressed, (in lieu of sponge, as in No. 2,*) and the perforated plates of zinc were covered, on their inner surfaces, with tinned brass gauze wire sieves, of exceeding fineness. The compactness of the sand is further increased by burnishing the external shell. Several varieties of these sand filters were examined by the Committee containing strata of sand varying in fineness of grain.

The mode of using Mr. Jennison's filters is to screw them on to a water pipe; the water, when laid on, passes through the filter under pressure in *very large quantities,* leaving upon it the coarser particles, until it becomes obstructed, and it is necessary to cleanse it. This is accomplished, not in the usual manner, (viz: that of reversing the current of water, and thus scouring the filtering bed,) but by reversing the filter itself, by unscrewing it, and attaching it, by the opposite female screw, to the nozzle of the pipe. In a few seconds the water, having removed the sediment, again will be delivered pure as before.

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* As the sponge and felt are subject to decay, Mr. J. has discontinued the manufacture of filters containing these materials.

The idea of *reversing the current*, for the purpose of cleansing filters is not new, for it has long been employed in Europe, and elsewhere, in closed filters of magnitudes varing from a few inches to several acres area. The plan of reversing filters is, moreover, not new: an old mode of tying a bag of felt-cloth to the nozzles of hydrants, and cleansing by removing it, and causing the water to pass through in an opposite direction, may be considered the same in principle.*

The Committee are of opinion that the filters of Mr. J. marked No. 3, (the sand filter,) *will be useful* in separating the larger particles of mud, vegetable matter, and many of the animalcules, minute eels, &c. from water, but that it is not capable of separating the *very fine* mud which abounds in streams after heavy rains.

During a few weeks of the year, when freshets prevail, the filter will not yield clear water, although it separates the greater portion of the mud, &c. At all other times, it delivers the water clear, and in vast quantities.

The introduction of several metals, such as brass, tinned wire, zinc colanders, soldered joints, &c., as component parts of the filter, must, from their galvanic relations, be productive of injury to the materials of the filter—lessening the durability of the apparatus.

By order of the Committee,

William Hamilton, Actuary.

Philadelphia, Nov. 11, 1847.

Monthly Meeting, November 18, 1847.

The usual stated business was first transacted, embracing the following subjects: the reading and adoption of the minutes of the previous meeting; announcement of donations; Treasurer's statement of receipts and expenditures; reports from standing and special committees; proposal of new members, 134 in number; election of those proposed at last meeting; resignations, &c.

Communications on subjects connected with Science and the Arts being next in order:—

Mr. G. W. Smith presented a specimen of *patent safety fuse*, for blasting under water, believed to have been made by Bacon & Bickford, of Simsbury, Conn. This was placed in a tub of water—each of the two ends projecting a few inches from the surface. One of the ends being ignited, the fuse burned throughout its whole length—that portion of the outer covering which remained under water being unconsumed, but that of the two projecting ends being completely burned. From the successful result of this experiment, it would appear that the article is well adapted to the purpose intended.

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* An old filter, described in the Dictionary of Arts and Manufactures, Paris, 1847, resembles the filter of Mr. Jennison, both in form and mode of operation; it is, however, larger, and the bed of sand is thicker; as the weight is greater, it is suspended on trunnions. The experiments tried by the Committee on larger filters gave much better results with turbid water than the small filters of Mr. Jennison.

Mr. Trego laid before the meeting two fine specimens of *gum copal*, presented for the Cabinet of Arts and Manufactures of the Institute, by Mr. Schrack, of Philadelphia. One of these, of large size, is cut and polished so as to exhibit its beautiful color and transparency, more resembling an enormous topaz than a production of the vegetable kingdom.

Prof. W. R. Johnson presented a specimen of *Cadmia*, from an iron furnace at Housatonicville, near West Stockbridge, Mass. This is a substance frequently found adhering to the inner walls of blast furnaces, about six feet below the tunnel head, or just below the charge of fresh ore, where it forms a ring, which, as it increases in thickness, becomes troublesome, by impeding the descent of the charge. The color of this substance is not always the same, being sometimes yellow, orange, dark green, or nearly black. Its specific gravity is about 5. It is soluble in sulphuric, nitric, hydrochloric, and acetic acids—and, by the application of the proper tests, zinc is found to be its principal metallic constituent. Prof. J. observed that a similar substance is found in the furnaces of Belgium, where it is esteemed a valuable material for combining with copper, in the manufacture of brass. He explained the formation of this deposit by supposing it to be produced by the oxidation of zinc contained in the iron ore, and deposited on the walls of the furnace at a place where it is infusible, thus giving trouble to the manufacturers of iron. He suggests that a thorough roasting of iron ores before putting them into the furnace, will prevent the inconveniences arising from the formation of cadmia.

Mr. Trego remarked that he had frequently observed the formation of this substance in a number of furnaces in Pennsylvania, and he had collected several specimens of it, which, however, were somewhat different in external appearance from that presented by Prof. Johnson; being of a more compact and uniform texture, and of a yellowish, or greenish color. He believed that Prof. J. was correct in attributing the formation of cadmia to zinc contained in iron ores, having often seen, in broken nodules of the argillaceous ores found in the coal formations of this State, distinct and beautiful crystals of the sulphuret of zinc, enclosed in the iron ore.

Prof. Johnson next exhibited two specimens of sediment, or incrustation from the interior of a steam boiler used at Burlington, N. J., for raising water from the Delaware; the boiler being, it is said, supplied with water from the river. One of these specimens is much more dense and solid than the other, which presents a highly porous or cavernous structure. The specific gravity of the solid cake is 1·235; the other is so light as to float upon water, at least for a short time. The color is a dark brown, approaching to black; the consistency that of soft chocolate. It has a faint odor, resembling that of beef tallow, or suet. Heated to a temperature of 230°, the mass becomes softened;

at 260°, may be easily moulded by the fingers, and the odor is perceptibly increased; at 480°, it still retains its consistence, and, on cooling, the color is changed to a lighter brown; at about 900°, it softens, intumesces, and burns with a brilliant flame, giving forth the peculiar odor of burning tallow, or animal oil. The result of continued combustion is a dark grey ash, amounting to 34·88, per cent; showing that 65·12 per cent. of the mass was combustible matter. Being digested in ether, 11·34 per cent. is dissolved; from this, after evaporating the ether, results a yellowish brown substance, of waxy consistence, having an odor approaching that of taurine. The ashes effervesce with acids, and are partly dissolved—the solutions yielding both lime and magnesia; the remainder appearing to be oxide of iron and silicate of alumina. Prof. J. further remarked that a substance like this, might, if highly heated, produce an explosive gas, and remarked upon the danger of allowing oil, or fatty matter, to enter the boiler with the water. In the lighter specimen, it is evident that the cavernous structure is the result of the passage of numerous bubbles of gas, or steam. He accounts for the character of this deposit by supposing it to be a species of soap, formed between the earthy oxides and the acids of animal fat.

MECHANICS, PHYSICS, AND CHEMISTRY.

Economical Process of making Bichromate of Potash, from the Chromates of Lead and the Bichromate of Lime. By M. V. A. Jacquelain.

TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

This process was performed, for the first time, in June, 1845, upon a quantity of 10 kilogrammes, at the establishment of M. Guerin, late Professor of Chemistry in the Normal School. Afterwards, in the month of September, of the same year, the experiment was repeated with 50 kilogrammes of chrome ore, near Rouen, by M. Maze, manufacturer of soda, and one of our most skilful operators.

M. Allain, on his part, published, in November, 1846, in the *Revue Scientifique*, a process which resembles mine, so far as regards some of the primary materials; but that which I am now about to set forth differs from the preceding in the details of execution, and in the study of the principal phenomena, a perfect knowledge of which is inseparable from all industrial enterprise.

Explanation of the Process.—1. Mix together, in casks revolving upon their longer axes, chalk and chrome ore, previously reduced to a very minute state of division. This tenuity of the ore may be obtained by pulverization, and then passing it through a very fine sieve; for it is important, above every other consideration, to have an impalpable powder, for reasons which will be presently shown.

2. Calcine this mixture for nine or ten hours at a lively red heat, upon the hearth of a reverberatory furnace, taking care to spread it to

a thickness of five or six centimètres, and to stir it well ten or a dozen times with a rake, or poker.

At the end of this time, if the flame has been sufficiently oxidating, the conversion of the oxide of chrome into chromate of lime will have been accomplished. This may be ascertained, first, by the appearance of the material, which will be of a yellowish green color;* and next, by its having the property of dissolving completely in hydrochloric acid, with the exception of the sandy portion.

3. Having proceeded thus far, the material, now very friable and porous, is next ground fine, and diluted with warm water. The liquid mass is constantly stirred, while sulphuric acid is added until the liquor will slightly redden blue litmus paper. This character is an indication of the total conversion of the chromate of lime into a bichromate, and of the formation of a little sulphate of the sesquioxide of iron.

4. Diluted chalk is then added, little by little, to the liquor, until the sesquioxide of iron is completely eliminated. In this the bichromate of lime undergoes no change as to its condition of saturation.

5. After remaining a short time at rest, the supernatant clear liquor is drawn off—this contains only the bichromate of lime, with a very little sulphate of lime. In this condition it may be immediately used for the production of bichromate of potash, the neutral or basic chromates of lead, and even the chromates of zinc, of which the approaching use may be foreseen, inasmuch as the oxide of zinc has already been so happily substituted for the carbonate of lead in white oil painting.

It will be seen, from the preceding, that it is not necessary to use the bichromate of potash in order to obtain the insoluble chromates of lead, zinc, baryta, &c., and this should bring about a great economy in the preparation of these articles. It is sufficient, therefore, to produce a double decomposition between the bichromate of lime and the acetate, the sub-acetate of lead, the chloruret of zinc, and so on of others.

With regard to the bichromate of potash, it is produced not less easily, nor less pure, by causing a reaction of a solution of carbonate of potash freed from soda, upon the bichromate of lime, from which results an insoluble carbonate of lime, easily washed, and bichromate of potash in solution, which must be concentrated and crystalized under protection from dust, and all access of hydrochloric acid.

Comptes Rendus, Oct. 11, 1847.

On the Influence of Rapid Motion of the Piston upon the Effect of Steam in Engines working expansively: with Experiments upon the subject. By M. Paltrineri.

TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

The researches and numerous experiments which I have made upon the application of motive power to machines, and particularly my experiments upon the effect of springs, have convinced me that in the expansion of steam there is a loss of power: a loss which should have a certain relation to the number of superimposed strata of steam which occupy the cylinder, from its bottom to the piston. These strata, moving with the piston, should naturally develope themselves, in order to follow and push it; and it is in this development of strata, one after the other, that the steam must employ a portion of its force, a portion which is certainly lost to the engine. The greater the number of strata, the more rapid is their development; and the more power that is thus absorbed, the less will there remain for useful effect.

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* This singular peculiarity of the chromate of lime with an excess of base, of preserving the green tint of the oxide of chrome, gave rise to the belief, for a long time, that it was not produced by the chromate of lime, and the more so, as this chromate is hardly soluble in water.

Suppose the steam introduced into a cylinder to be intercepted at the moment when the piston has reached a fourth or a third part of its stroke, to give place to the expansion: from this moment we may imagine the fluid mass divided into a determinate number of successive parallel strata, and beginning to develope and expand themselves to drive the piston and follow it. It will then be apparent that the stratum nearest the piston will, without doubt, be able to exert upon it all its effort, and all the rapidity of which it is capable; but it will be also apparent that the one which follows cannot do as much, because the preceding stratum constrains it, by pushing it backwards at the same time that it forces the piston forwards. By its condition as an elastic fluid, steam should naturally expand every way, and maintain at the same time, as is admitted, a uniform density throughout its volume—consequently, the stratum which drives the piston on one side, repels, on the other, at the same time, the stratum which follows it, although allowing itself to be penetrated by it; the latter repels the one which follows it, and so on to the last, which is at the bottom of the cylinder.

There must, therefore, be a collision between one stratum and another, on account of the difference in their velocities, and of the necessary compenetration of one stratum into another, in order that the uniformity of density may be maintained. This collision must evidently produce a loss of power—a loss which should be proportional to the differences of the velocities, and which will be the more considerable according as the number of successive strata is increased, and as the expansion takes place more quickly.

It is from these considerations, confirmed by the results of experiments upon the effect of helical springs, that I am persuaded that a given quantity of steam, working by expansion, will produce more disposable and useful effect acting upon a piston of a large surface and short stroke, than upon a piston of smaller surface and with a stroke proportionably longer, all other circumstances being equal. Desirous of determining the truth of this opinion by rigorous experiment, I caused two steam engines to be constructed under conditions strictly equal, and calculated to produce the same dynamic effect, according to admitted principles. But in one of them, the relation of the surface of the piston to the length of the stroke was in an inverse ratio to that of the other: that is, if one of the pistons had a surface of 20 and a stroke of 24, the other had a surface of 80 and a stroke of 6; so that the volume produced by the movement of one piston is precisely equal to that of the other. There is, therefore, exactly the same quantity of steam entering and leaving the two cylinders at each stroke of the piston, and, consequently, when the number of strokes is the same, in a given time, in each of the two engines, it ought to be certain that there is the same volume of steam, in the same physical and mechanical conditions, used by each cylinder. These experiments, of which a table is given, were made with all possible precaution, in order that all the conditions of the apparatus should be identically the same; they were repeated several times, on different days, and in the presence of several competent persons. The following table shows the mean of the results obtained in several series of experiments, the apparatus being always kept under the same conditions:—

No. of Experiment.	Kind of Cylinder.	Weight on the Brake.	Revolutions per Minute.	Virtual velocity of end of brake lever.	Pressure on Steam gauge.	Cut off, or Space for expansion of Steam.	Effect, in kilogr'm's raised 1 metre per second.	Ratio of Effect between the two Engines.
		Kilog's.			Atmosph.			
1	Wide	1·814	150	7·854	$\frac{4}{10}$	Full of steam.	14·247	1·00
	Narrow	1·614	150	7·854	$\frac{4}{10}$	Full of steam.	12·676	·88
2	Wide	1·754	168	8·796	$\frac{9}{20}$	$\frac{1}{2}$	15·428	1·00
	Narrow	1·418	168	8·796	$\frac{9}{20}$	$\frac{1}{2}$	12·472	·80
3	Wide	2·127	174	9·110	$\frac{6}{10}$	$\frac{2}{3}$	19·376	1·00
	Narrow	1·277	174	9 110	$\frac{6}{10}$	$\frac{2}{3}$	11·633	·60
4	Wide	2·116	156	8·168	$\frac{8}{10}$	$\frac{5}{6}$	17·283	1·00
	Narrow	0·916	156	8·168	$\frac{8}{10}$	$\frac{5}{6}$	7·481	·43

The numbers in this table will show, at a glance, the difference of effect between the two engines. Although every precaution was taken to avoid error in the measurements and observations, and though the numbers in the table only show the mean result of several series of experiments, I do not assert that the ratios there given are strictly those which should result from the physical law of this phenomenon. New experiments, with engines of greater power, and an exact calculation with regard to the results obtained, can alone establish, with the accuracy desirable, all these relations. I believe, however, that the reasoning upon which my opinion is founded, and the results of the experiments which go to confirm it, authorize me to make the following conclusions:—

1. That the velocity of the piston has a much more remarkable influence upon the useful effect of steam than has been heretofore supposed.

2. That this influence is very greatly increased, and according to a certain ratio, on account of the amount of expansion which is allowed to the steam; the greater being the expansion, the greater is the difference of effect.

3. That in order to obtain from steam the greatest amount of useful effect, it is necessary to use cylinders as wide and short as may be practically convenient, and that the piston should move at a very low velocity.

It is certainly not unknown that the effect of steam has a relation to the velocity of the piston; but it has not yet, so far as I know, been recognized that the velocity of the piston has a particular and considerable influence upon the effect of the expansion; and I believe myself to be the first who has directed attention to this subject, and who has sought to demonstrate the truth by experiment. The numbers in the table show, in effect, very considerable differences, although the velocities of the two pistons appear only in the ratio of 1 to 4. The experiments mentioned have manifested two other phenomena which have attracted my attention, and which I recommend to the notice of scientific persons: the first is, that in the engines which I used, and when they were worked by expansion, the pistons were compelled, in some of the experiments, to complete their stroke while having against them (on account of atmospheric pressure) a resistance stronger than the force by which they were impelled. The other phenomenon is relative to the work done by the two engines. In most of the experiments made, the useful effect, as measured by the brake, was always, and even considerably, more than the theoretical effect of the motive power. Does this difference of effect depend upon the partial vacuum created in the escape pipe on account of the rapid passage of the steam, so that the pressure upon the piston has a relatively greater force? May this rarefaction in the escape pipe also account for the continuance in the stroke of the pistons, although they may have been placed in equilibrium by atmospheric pressure before making a half, or two-thirds, of their stroke?

All these questions, the importance of which will be readily perceived by men of science, have need of study and elucidation by experiments, perhaps of a different kind. On my own part, I shall do all that I can; but I call for the aid of learned persons who are conversant with such matters. Comptes Rendus, Sept. 27, 1847.

Note, in support of the Opinion advanced by M. Joule, upon the Identity of Motion and of Caloric. *By* M. Seguin, Senior.

TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

In a work which I published in 1839, upon the influence of railroads, I advanced the opinion that steam was only the medium which is used for the production of force, and that reciprocally; and that there must exist, between caloric and motion, an identity of nature in such manner that these two phenomena are but the manifestation, under a different form, of the effects of a single and the same cause.

These ideas were communicated to me, long ago, by my uncle, Montgolfier; and I only waited, before giving them publicity, until positive experiments and well-established facts should give them the sanction of demonstration.

Under these circumstances I learned, by the *Compte Rendu* of the session of 23rd June last, of the experiments made by M. Joule: and found that the results which he had obtained gave so much force to the opinion of the celebrated man who had advanced the same idea more than fifty years since, that I thought it my duty to submit to the Academy the important consequences which, it seems to me, may result therefrom.

In his article, M. Joule considers caloric as free from bodies, and demonstrates that the heat required to increase the temperature of one gramme of water, one degree of the thermometer, is equal to a mechanical force capable of raising a weight of 430 grammes, one metre in height.

Now, in regarding this question under a point of view altogether different from that of M. Joule, I have arrived at an almost identical result. Having supposed, in effect, that the decrease of temperature resulting from the expansion of a gas which extends itself throughout a space larger than that which it previously occupied, represented the mechanical force which then appeared; I calculated the number of kilogrammes of water that a cubic metre of steam, at 180 degrees, (Centigrade) could, by its expansion, elevate one metre in height, according as its temperature decreased—and calculating the products for every 20 degrees, up to 80. In reducing my results to the type of one gramme raised one metre in height, adopted by M. Joule, and correcting them as regards the ratio of the specific heat of water to that of steam, I found that the amount of mechanical power developed by a gramme of water, raised one degree in temperature, was as follows:—

Between 180° and 160° = 395 gr.
" 160 " 140 = 412 "
" 140 " 120 = 440 " } Mean, 449 grammes.
" 120 " 100 = 472 "
" 100 " 80 = 529 "

These results oscillate, as will be perceived, about the number 430, which was arrived at by M. Joule; and this notwithstanding, as I have said, that we are placed in an altogether different point of view. M. Joule has considered the caloric as free, and the pure and simple elevation of the temperature of water a certain number of degrees, in a thermometrical scale circumscribed between two or three degrees; while I have regarded the caloric as latent, or the variation of temperature which steam undergoes in passing from one state of pressure to another, and that within the most extended limits, inasmuch as they vary between 80 and 180 degrees, in which it is hardly possible to be certain that the thermometric scale, used to measure the temperature, really represents the quantities of caloric which it indicates. And it is from this, perhaps, that arise the differences of mechanical power developed by steam, between the two extremes of the scale of results which I have obtained—results which would have presented themselves in a very different manner, and even, perhaps, in an inverted sense, if, instead of mercury, a thermometer constructed of any other substance had been used—the expansion of bodies, according to the variation of their temperature, being, possibly, a property which is not subject to the same law as that of the amount of mechanical power which they then develope.

If, in conjunction with these facts, we consider a great number of others in which caloric is known to be produced by motion, such as percussion, compression, friction, change of condition, or of nature, we shall be convinced that the two phenomena, identical in themselves, are but the consequences of a general law which governs the movement of all bodies; and that the phenomena which we designate under the title of *caloric*, are nothing but the effects of the communication of motion of bodies among themselves, when they are reduced to a state of division of which we cannot appreciate the intensity, or the circumstances, as we are able to do when these same bodies have, in mass, a movement which may be measured by the sensible effects which it produces.

I shall not undertake to enumerate all the consequences which would result from the adoption of this principle, and chiefly the modifications which it would produce in the application of steam to the production of power.

In steam engines of medium pressure, which are those presenting the most advantages, the steam is used between the limits of pressure which I consider equal, approximatively, to a reduction of 80 degrees of temperature, after which the elasticity of the steam is destroyed by condensing it, or it is allowed to escape into the air. But it is evident that, in this state, the steam still contains 630 degrees of heat which is not made useful, and that we might, by continually using the same steam, and restoring to it at each stroke of the piston the quantity of heat which has been lost in the act of producing the motion, obtain results which would bring about a complete and immense revolution in this department of mechanics which has become so interesting at the point of civilization to which we have now arrived.

With the view of explaining facts which, at the first glance, appear so little to be derived from the same source, and of which it will be so important to give an explanation showing that they class themselves naturally under the law of universal gravitation, I have undertaken a work which I propose to submit to the Academy so soon as it may be in a sufficient state of forwardness to merit serious attention from them. Comptes Rendus, Sept. 20, 1847.

On the Anomalous Specific Heat of certain Alloys, and their spontaneous Increase of Temperature after Solidification. By M. C. C. Person.

TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

M. Regnault has discovered, in alloys fusible at about 212° F., a specific heat much greater than the mean of the metals composing them, and proposes to examine whether this anomaly does not disappear at lower temperatures. The experiments reported in my memoir show that it does, in effect, disappear. Thus, in the alloy of d'Arcet,* I have $c = 0{\cdot}069$ from 201·2°, and $c = 0{\cdot}037$ from 122°; as the calculated mean is 0·036, it will be perceived that the difference is very trifling. The principal difficulty in these researches was to heat the alloys to exact temperatures below 212 degrees; for this purpose I used a stove of simple construction, of which a drawing is annexed to the memoir.

This point being explained, I make it appear that the excess of heat observed in this alloy, near its melting point, is not owing to the commencement of fusion, as might be imagined, but to a new kind of latent heat of which the following experiment shows the evolution. A glass bulb, filled with the alloy in question, is isolated in such manner that the cooling may be observed; and for that purpose there is fixed in the alloy a thermometer, of which the changes may be noted with an eye-glass and stop-watch. Suppose the glass vessel to contain 150 grammes of the alloy of d'Arcet, the thermometer, which, at about 266 degrees, takes five or six seconds to fall two degrees when the alloy is in a liquid state, takes more than 400 seconds to fall 3·6° degrees between 204·8° and 201·2°. This is very simple: the latent heat of fusion is being disengaged during this interval. The solidification being completed, the thermometer resumes a regular rate, falling one degree in five or six seconds, until about 134·6 degrees, where it suddenly stops, and even rises two or three degrees. At the same time, the glass bulb is broken by a considerable expansion of the whole mass, and this expansion continues after the cooling, so that the thermometer, which was before strongly pressed, becomes free and movable. There is, therefore, in this, a change of constitution in the alloy, and the heat which was disengaged during this modification was sufficient to sustain the thermometer between 136·4 and 132·8 degrees for more than 400 seconds; but it then immediately fell one degree in five or six seconds. The disengagement of heat afterwards continues for a long time, of which we have proof by the extraordinary slowness of the cooling.

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* This alloy is composed of bismuth, 8; lead, 5; and tin, 3. It is known as "Newton's Fusible Metal," and melts at a temperature below that of boiling water.—Com. Pub.

In order to measure the heat, I employed a process which was used by Rudberg on another occasion; but I availed myself of a means of verification which, I hope, will remove the uncertainty for which he was reproached by M. Despretz. I observed, comparatively, with a chronograph, the cooling of the alloy and that of another body as identical as possible, and placed in the same circumstances. The heat lost by this body at each degree being known, I had, approximatively, that lost by the alloy; but, moreover, I measured, with a calorimeter, the heat lost by the alloy between certain temperatures—the measure by cooling must necessarily have shown the same figures. I therefore had, as has been said, a means of verification and correction. The tabular statement of cooling, thus corrected, gives the heat lost by the alloy at each instant; the changes which take place in its specific heat are also shown, and the latent heat of fusion is also measured, as well as that which results from change of constitution—this last is about three calorific units per gramme, for the alloy of d'Arcet. There is another mode of measuring it which is less exact, but which leads to a curious result. After having melted the alloy, I allowed it to become solid, and then to cool down only, for example, to 201·2 degrees, in order that the heat of decomposition should not be disengaged. Then passing it into a calorimeter, it gave 7·4 cal.—but on reheating again to 203 degrees, I could only obtain 5·2 cal.; so that I arrived at this paradoxical result: that the same body contains least heat when it is the hottest. The difference, 2·2 cal., arises from the fact that the alloy, in reheating to 203 degrees, has only in part suffered a change of constitution.

If, after having melted the alloy, it be suddenly cooled by plunging it into water, and then withdrawn as soon as it may be safely handled, it will, in a few moments, become again so warm as to burn the fingers. Here, the sudden cooling is at first opposed to the change of constitution; but a moment arrives at which the disposition of the molecules ceases to be compatible with so low a temperature, and then the new arrangement takes place. And, on account of having been thus retarded, it recurs with much more energy, that is, in a much shorter time—it is not only a slower cooling which is observed, but a reheating which may carry the mass to 158 degrees.

To recapitulate: the excess of caloric given out by alloys when heated nearly to their melting point, does not proceed from the latent heat of fusion; nor should it be considered as being simply specific heat—it is heat due in a great measure to change of constitution, which may take place in an alloy completely solidified and considerably below its melting point. Comptes Rendus, Sept. 27, 1847.

Artificial Minerals.

The experiments of M. Ebelmen, to produce minerals artificially, communicated to the Academy of Sciences, Paris, are thus given in

L'Institut: the immediate subject being chiefly the varieties of the ruby:

"The method I adopted to crystalize these compounds, depended upon the property of boracic acid to dissolve all the metallic oxides, and upon the great volatility of this acid at a high temperature. I thought that by dissolving, in melted boracic acid, alumina and magnesia, mixed in the proportions that constitute the spinel, and by exposing this borate in open vessels to the high temperature of the porcelain kiln, the affinity of alumina for magnesia would determine the separation of a crystalized aluminate, and the complete expulsion of the boracic acid. In short, I employed boracic acid at a high temperature, as water is used at ordinary temperatures, to obtain crystalized salts by evaporation alone. The proportions were about one part of melted boracic acid to two parts of alumina and magnesia, mixed synthetically to constitute the compound, $Al^2 O^3 MgO$; with the addition of a small quantity of the bi-chromate of potash. These materials, well mixed, were put on a platinum leaf, in a biscuit-cup, and exposed to the heat of a porcelain biscuit-kiln. I obtained a surface covered with crystaline facets, presenting in their interior reticulated cavities, the form of which was easily distinguished with the lens. These crystals were rose-colored, transparent, readily scratching quartz, and presenting the form of regular octohedrons, without any modification. They are quite infusible in the blow-pipe. These characters, joined to the composition of the crystals, synthetically ascertained, appear sufficiently conclusive to establish their identity with the spinel.

"By substituting for the magnesia its equivalent of the protoxide of manganese, a crystalized product is obtained in large laminæ, in the form of equilateral triangles, or of regular hexagons. These crystals, also, readily scratch quartz. I consider them to be the manganesiferous spinel $Al^2 O^3 MnO$, which has not yet been met with in the mineral kingdom.

"Oxide of cobalt, substituted for the magnesia, equivalent for equivalent, gave bluish black crystals, regular octohedrons. They, again, scratch quartz, but with more difficulty than the preceding."

In employing alumina and glucine in the proportions that constitute cymophane or chrysoberyl, $Al^2 O^3 GlO$, a bristling mass of crystaline asperities of great brilliancy is obtained. This product readily cuts quartz, and very cleanly topaz. It presents then a hardness comparable to the crystalized cymophane.

Certain silicates, infusible at the temperature of our furnaces, appear capable of being reproduced by the same process. Thus, in melting the elements of the emerald with half their weight of boracic acid, at the same temperature as in the preceding experiments, a substance is obtained, which easily scratches quartz, and the surface of which presents a great number of facets having the form of regular hexagons.

"I content myself," M. Ebelmen adds, in conclusion, "with submitting to-day these first indications, hoping, however, soon to present to the Academy a more detailed and more complete work. But I am convinced, at present, that it is possible to produce, at temperatures below those of our iron smelting furnaces, diaphanous crystals, the hardness and external characters of which are analogous to those of precious stones. It is probable that in repeating these experiments in apparatus of certain dimensions, like reverberating furnaces, by operating on large quantities of materials, and continuing the application of heat sufficiently long, much larger crystals may be produced than those I have obtained, working with a few grammes only. Another conclusion to be drawn from the preceding facts is, that many species of minerals have the power to produce themselves and crystalize at temperatures much below those necessary to melt them."

Specimens of the products mentioned in the communication were submitted to the Academy. Civ. Eng. & Arch. Jour.

Test for Distinguishing Iron from Steel.

To distinguish iron from steel by a chemical process, take pure nitric acid, dilute it with so much water that it will only feebly act upon the blade of a common table knife. If a drop of the acid thus diluted be suffered to fall upon steel, and allowed to remain upon it for a few minutes, and then washed off with water, it will leave behind a black spot. But if a drop of this acid be suffered to act upon iron in the same manner, the spot will not be black, but of a whitish-grey color. The black stain is owing to the conversion of the carbon of the steel into charcoal, which thus becomes predominant; and iron being nearly free from carbon, can produce only a grey stain. The utility of this test is not confined to finished articles manufactured of steel, but its application enables the workman in iron and steel to ascertain also the quantity and uniformity of texture of unfinished articles.

Ibid.

Improvements in Glass Chimneys for Gas-Lights, Lamps, &c.

Achromatized Light.—The unpleasant and, to many sights, painful effects of the naked flame of a candle, lamp, or gas-burner, have long been known and felt, as also that they are not by any means lessened by passing through colorless glass; and numerous experiments, and much research, have been followed up by scientific men, with the view of discovering means of improving the color of artificial light generally. The cause of the yellow glare perceptible during the combustion of all the hydro-carbons, is owing to the radiation of a superabundance of the red and yellow rays of the spectrum, and it is owing to the effect of these on the retina, that certain colors cannot be distinguished from others, when seen by artificial light. The principle has long been known to opticians, and in 1790, Dollond, of St. Paul's Churchyard, after many years of study and experiment, introduced the achromatic lens for telescopes, by which the iridescent halo, which obstructs and pains the sight in common glasses, is removed, or prevented, and the object is seen through a perfectly clear and colorless fluid-like medium. Mr. McNeill, of St. Martin's-lane, has introduced a glass chimney, which does for common artificial light what Dollond effected for the telescope. He has patented a glass chimney, colored, in its melted state, with a natural or slightly blue tint, which, when in use, obstructs the passage of the red and yellow rays, and leaves the flame of a mellow wax-like white, so imitative of daylight, that the various colors of the most delicate hues, such as ribands, silks, shawls, &c., can be most perfectly distinguished; and we understand, that more than one of our most eminent artists, who had entirely discontinued painting by gas or lamp-light, have, on obtaining the achromatic chimneys and globes, again taken to it; as they are as able to distinguish the most delicate contrast of color as by daylight. Achromatized light is, from its extreme purity, perfectly unirritating to the eye—a sensation of coolness and relief being produced, in place of the pain and fatigue caused by the hot glare of uncorrected light. The quality which it possesses, of enabling the eye to indicate with distinctness the smallest characters of type, or manuscript, renders it unrivalled for the purposes of study, reading, long-continued exercise of the pen, as in public and private offices, banks, counting-houses, clubs, literary institutions, &c.; in short, under all circumstances, and in all situations, a universal means of improved illumination.

Lond. Min. Jour.

On the Detection of Cotton in Linen. By M. Kindt.

The ingenuity which competition in our textile manufactures continually elicits is now too frequently directed to the production of a deceptive and fugitive appearance in goods, instead of the real improvement of the fabric. It is therefore desirable that the consumer, who is well pleased with the reduced cost of his goods, should be able to ascertain where the economy has been effected; or, in other words, what kind of fabric he has purchased. With the view of assisting him in this analysis, we gave, in Vol. XXX., a test, by M. Vincent, for ascertaining the presence of New Zealand flax in sail or other cloth; and, as a carrying out of the same idea, we now insert the experiments of M. Kindt (for which we are indebted to the Philosophical Journal), whereby the presence of cotton may be detected when combined with flax; and perhaps, at the present time, such a test may be the more required, as a recent invention for polishing thread, has enabled the manufacturer to produce that article, with very inferior materials, superior in gloss and apparent firmness to thread made of the best flax.

"This subject has frequently engaged the attention of commercial and scientific men; many experiments have been made, in order to detect cotton thread in linen; many processes have been recommended, but none have hitherto proved satisfactory. I was therefore much surprised when a stranger, a few weeks ago, showed me a sample of linen, from the one-half of which all the cotton filaments had been eaten away. He had obtained it in Hamburg, and asked me whether I could give him a process for effecting this purpose. Now since, as far as I am aware, nothing has been published on this subject, and it is of very general interest, I consider it a duty to communicate the results of my experiments. I had already observed, in experimenting with explosive cotton, flax, &c., that these two substances behave somewhat differently towards concentrated acids; and although it has long been known that strong sulphuric acid converts all vegetable fibre into gum, and when the action is continued for a longer period, into sugar, I found that cotton was metamorphosed much more rapidly by the sulphuric acid than flax. It is, therefore, by means of *concentrated sulphuric acid* that cotton may be removed from linen when mixed with it; and this object may be obtained by the following process:—

"The sample to be examined must be freed, as perfectly as possible, from all dressing, by repeated washing with hot rain or river-water, boiling for some length of time, and subsequent rinsing in the same water; and I may expressly observe, that its entire removal is requisite for the experiment to succeed. When it has been well dried, the sample is dipped for about half its length into common oil of vitriol, and kept there for about half a minute or two minutes, according to the strength of the tissue. The immersed portion is seen to become transparent. It is now placed in water, which dissolves out the gummy mass produced from the cotton: this solution may be expedited by a gentle rubbing with the fingers; but since it is not easy to remove the whole of the acid by repeated washing in fresh water, it is advisable to immerse the sample, for a few instants, in spirits of hartshorn (purified potash or soda have just the same effect), and then to wash it again with water. After it has been freed from the greater portion of the moisture, by gentle pressure between blotting-paper, it is dried. If it contained cotton, the cotton threads are found to be wanting in that portion which had been immersed in the acid; and by counting the threads of the two portions of the sample, its quantity may be very readily estimated.

"If the sample has been allowed to remain too long in sulphuric acid, the linen threads likewise become brittle, or even eaten away; if it were not left a sufficient time in it, only a portion of the cotton threads have been removed: to make this sample useful it must be washed, dried, and the immersion in the acid repeated. When the tissue, under examination, consists of pure linen, the portion immersed in the acid likewise becomes transparent, but more slowly, and in a uniform manner: whereas, in the mixed textures, the cotton threads are already perfectly transparent, while the linen threads still continue white and opaque. The sulphuric acid acts upon the flax threads of pure linen, and the sample is even somewhat transparent, after drying, as far as the acid acted upon it; but all the threads in the sample can be seen in their whole course.

"Cotton stuffs, containing no linen, dissolve quickly and entirely in the acid; or, if left but one instant in it, become so brittle and gummy, that no one will fail to recognise it as cotton, when treated in the above manner."

Lond. Journ. of Arts & Sci.

M. Ledoyen's Disinfecting Fluid.

The English journals have been busy of late in discussing the relative and absolute merits of chloride of zinc and nitrate of lead, as antiseptic and disinfecting agents. It appears that in the year 1840, Sir William Burnett, Director General of the Medical Department of the British Navy, took out a patent for preserving animal and vegetable substances by means of chloride of zinc, and its application was directed entirely to the prevention and suspension of decay. Since then the patentee has brought his liquid before the public as a disinfectant applicable to destroy deleterious and offensive effluvia, such as those of a contagious character in fever hospitals, etc.

More recently, a preparation called "Ledoyen's disinfecting fluid," has been brought into notice, which is represented to "possess the property of destroying the offensive effluvia of cesspools, drains, sick rooms, &c., and preventing the spread of contagious diseases. It was the design of M. Ledoyen to submit the merits of his "fluid" to a committee of Parliament, that if substantiated he might receive a reward from government, for divulging the composition of his preparation. He refused, meanwhile, to place the disinfectant in the hands of any party who did not obligate himself not to examine it; but the editor of the Pharmaceutical Journal having obtained possession of a specimen, without this condition, he states it to be a solution of nitrate of lead, which has since been acknowledged by the parties.

The antiseptic power of chloride of zinc, has been too fully established in the dissecting rooms of this city to need comment—but in reference to the more important power of a disinfectant that has been attributed to it, there is much doubt. The disinfecting action of both the substances is founded on the premises, that hydrosulphuric acid is the cause of contagion and fœtor, in the miasm and exhalations from decomposing animal matter, the truth of which is by no means perfectly established, else, as Mr. Bell observes, why do not the occupants of our laboratories become diseased through its influence. Admitting that sulphuretted hydrogen is the noxious agent to a certain extent, the question arises, are these salts efficient in decomposing and neutralising its effects?

Chloride of Zinc.	*Nitrate of Lead.*
If neutral chloride of zinc be treated with sulphuretted hydrogen, but a small part of the salt, will undergo decomposition forming sulphuret of zinc and hydrochloric acid.	If nitrate of lead be treated with hydrosulphuric acid, sulphuret of lead will be formed and nitric acid and water be set free.
The presence of free acid in solutions of zinc salts, prevents their decomposition by the gas, and hence the disinfecting action of the solution is destroyed.	As the salts of lead are decomposed by the gas in question, in the presence of free acid, the disinfecting action will not cease till all the salt has been decomposed.

The conclusion arrived at is that chloride of zinc has very decided powers as an antiseptic—whilst nitrate of lead is far more efficient as a destroyer of noxious effluvia containing sulphur.

In reference to Ledoyen's solution, the discoverers speak of its powers in the following terms:

1st. "It disinfects night soil, not destroying but increasing vegetation, more particularly as regards agriculture; *completely preventing the disease in potatoes,* when the land is manured with disinfected night soil.

2d. "It disinfects hospital wards of miasma, also cellars, water closets, and buildings infected by impure gases.

3d. "It disinfects sailors suffering from fever on board vessels; it will also disinfect ships at sea, and under quarantine.

4th. "It disinfects patients suffering with infectious disorders and wounds; also dead bodies, so that they may be kept nearly a month; also different parts of the body can be kept for the purpose of dissection, for coroner's inquests, &c.

Finally. "This process is most effectual as a sanatory remedy for towns, &c."

It may readily be conceived that a preparation promising such immense advantages to mankind, would attract the attention of government and the public. Accordingly, Lord Morpeth, as Commissioner of Her Majesty's Woods and Forests, submitted the "fluid" to the deliberate examination of Dr. Southwood Smith, Mr. Toynbee, and Mr. Grainger, in connexion with the discoverers, whose report was extended over many pages; but of which the following are the conclusions:

"1. That this fluid does not possess any peculiar power in preserving the dead body from decomposition, and that, therefore, it is not applicable to any considerable extent to purposes of dissection.

"2. That it removes the fœtor of putrifying substances, vegetable and animal, by decomposing the sulphuretted hydrogen upon which that fœtor chiefly depends.

"3. That it is capable of preventing the disengagement of sulphuretted hydrogen in sick chambers, and in the wards of hospitals, and of removing it in a few minutes, when it is present, not merely by dissipating the smell, but by destroying the poison.

"4. That the use of it is simple and easy, and as the occasions on which it is required are of constant occurrence, and as it has the peculiar advantage of being itself inodorous, its possession would be a comfort and blessing to private families.

"5. That by decomposing the sulphuretted hydrogen, it removes from night-soil the poison which renders such matters injurious to health and dangerous to life, and by changing the ammonia from a volatile into a fixed substance, and thereby preventing its escape and loss, it preserves in the night-soil the principle which renders it chiefly valuable as a manure, while it presents that principle to the plant in a form which is known to be highly beneficial to vegetation.

"6. That, as it renders the removal of night-soil practicable without creating a nuisance, it ought, in our opinion, to be made a matter of police regulation, that no privy or cesspool should be emptied without the previous use of a sufficient quantity of it to destroy all offensive smell."

The reporters have evidently avoided the chief question at issue, and directed their answers merely to the action of the fluid on sulphuretted hydrogen, without noticing other deleterious gaseous exhalations or referring to the powers of the liquid in disinfecting miasmatic and contagious atmospheres. The following exposition of the case was submitted to the referees by Dr. Leeson of St. Thomas's Hospital, and is so clear in reference to the objects proposed to be accomplished by the discoverers, that it is introduced here without abridgement:

"The decomposition of animal and vegetable substances gives rise, as it is well known, to septic or infectious miasmata. Those arising from vegetable putrescence, generating disease and fevers of a remittent type, whilst those arising from animal matter are distinguished by a typhoid character.

"Such miasmata, although so dangerous, are not, it is believed, to be distinguished by the smell, and are most probably composed of vegetable and animal organizations so minute and subtle, as to elude the cognizance of those methods and instruments of investigation which have hitherto been employed.

"The fœtid and offensive gases or vapors consist of combinations of hydrogen with sulphur, phosphorus, nitrogen, and carbon.

"The most offensive compounds are those of hydrogen with sulphur and phosphorus, forming sulphuretted hydrogen (or, as it is otherwise termed, hydro-sulphuric acid) and phosphuretted hydrogen gases.

"The ammonia resulting from the combination of hydrogen and nitrogen, although odorous, can scarcely be termed an offensive compound, but being commonly combined with sulphuretted hydrogen, it then furnishes a highly offensive substance.

"The compounds of carbon and nitrogen forming cyanogen; of cyanogen and sulphur forming sulpho-cyanogen, and of carbon and hydrogen forming light carburetted hydrogen, may be reckoned amongst the less offensive, although volatile ingredients of the putrefactive vapors, but which combine to complete the farrago of unpleasant odors.

"The compounds of carbon with oxygen forming carbonic oxide and carbonic acid, although fatal to animal existence when too largely respired, can scarcely be considered as offensive compounds.

"To recapitulate: we may divide and distinguish the elements of animal and vegetable putrescent vapors thus:

Dangerous, but inodorous.	*Odorous, but slightly offensive.*	*Most offensive.*
Remittent miasmata,	Ammonia,	Sulphuretted hydrogen,
Typhoid miasmata,	Carburetted hydrogen,	Phosphuretted hydrogen,
Carbonic oxide,	Cyanogen,	Hydro-sulphate of ammonia.
Carbonic acid.	Sulpho-cyanogen.	

"Two methods naturally suggest themselves to the chemist by which such dangerous and offensive compounds may be destroyed or prevented.

"First. To alter or otherwise form their component elements into new elements, which are neither dangerous, fœtid, nor offensive.

"Secondly. To fix certain of the elements so as to render the substances themselves no longer volatile, and consequently neither odorous nor offensive.

"First Method. The principal re-agent heretofore made use of in the destruction of animal and vegetable miasmata and for the decomposition of the offensive compounds of hydrogen with phosphorus, sulphur, &c., is chlorine, the efficiency of which is dependent on its great affinity for hydrogen, with which it forms hydro-chloric, or, as it is commonly termed, muriatic acid. Unfortunately chlorine is itself an offensive, irritating, and corrosive substance, which will account for its not having been more extensively employed, although the cheap combination of chlorine and lime is applicable as a disinfecting agent, and might, it is believed, be advantageously employed.

"Second Method, by Fixation. This method is chiefly applicable to the sulphuretted hydrogen, which may, as is well known, be decomposed by a great number of metallic salts. These salts consist of an acid in combination with the oxide of a metal. When sulphuretted hydrogen is passed through or added to a solution of one of the salts alluded to, its sulphur combines with the metal, forming an insoluble inodorous metallic sulphuret.

"The hydrogen combines with the oxygen of the metallic oxide, forming water, and the acid of the metallic salt is set free.

"With regard to the particular process of M. Ledoyen, the experiments conducted by that gentleman at St. Thomas's Hospital led to the conclusion that his process was founded on the second method before alluded to: namely, that of the fixation of the sulphuretted hydrogen by a metallic salt, and that the actual metallic salt employed was ——.*

"This opinion has been frequently verified by M. Ledoyen himself, who, in the most candid manner, not only admitted the composition of his fluid to be such as is here stated, but also delivered a bottle of it to Dr. Leeson for analysis and further experiment.

"In regard to its efficacy as a disinfecting agent, the general result of these experiments establish the conclusion that the efficacy of this process is confined to the removal of the unpleasant odors due to sulphuretted hydrogen and hydro-sulphate of ammonia. As the sulphuretted hydrogen is the most abundant and most offensive of the various products of animal and vegetable decomposition, it is evident that although this process cannot remove the whole of the offensive odors, it is still well suited to effect a very important and extensive amelioration of the nuisance arising therefrom.

"In regard to the application of this liquid as a dressing to putrescent sores, there can be no doubt that it will be found useful, and that it possesses several advantages over those in common use; among others, that it is itself inodorous, that it corrects the fœtid exhalations arising from sores, and that it eliminates one of the most excellent applications to gangrenous sores yet known.

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* This omission occurs in the Report, as here printed.

"In regard to the last and most important application of the disinfecting fluid to the removal of the fœtid and most offensive odors arising from privies, cesspools, night-soil, &c., it will appear from what has been already stated, that so far as the offensive effluvia result from sulphuretted hydrogen and hydro-sulphate of ammonia, this liquid will totally remove them.

"The odor resulting from phosphuretted hydrogen, and from the other less offensive compounds, will still remain; but as these odors are neither so offensive nor so readily diffused to a distance as the sulphuretted hydrogen, a most important and beneficial improvement will be effected, particularly in the process of removal.

"It remains to consider what benefits or injuries may result from the employment of this liquid in respect to the subsequent use of the night-soil as manure.

"Two important advantages will no doubt be attained; the one, the conversion of a prejudicial and poisonous ammoniacal salt: viz., the hydro-sulphate of ammonia, into an inodorous and highly fertilizing compound: viz., the nitrate of ammonia. The other advantage is, that by removing that poisonous and injurious compound, thereby saving the long and offensive exposure of the night-soil to the air, which would be otherwise necessary, and which is not only disagreeable, but, by the consequent loss resulting from the volatility of the ammoniacal salts, it is also injurious.

"On the other hand, there is one problematical objection to the extensive applications of this fluid as a manure to land: namely, that the small quantity of the metal employed may possibly, by its accumulation, be productive of ultimate mischief; but this requires further investigation and experiment.

"The above suggestions are made without any desire to detract from the merit due to Messrs. Ledoyen and Calvert, in having thus directed public attention to the use of chemical re-agents as a means of removing a very serious and dangerous impediment to the sanatory condition of towns."

The above facts and statements are chiefly derived from the editorial discussion of the subject, in the August and September numbers of the Pharmaceutical Journal.

It has recently been stated in our daily papers that the frigate Raritan, which had been abandoned at anchorage in Chesapeake Bay, owing to the contagious miasm that infected her hulk since returning from the tropics, was entirely disinfected by the application of some disinfecting agent, the name of which was not mentioned. May it not be one of the salts in question, most probably the nitrate of lead?

Am. Jour. of Pharmacy.

General Rules for the Quantitative Analysis of Soils. By Isaiah Deck, F. G. S., &c., *Analytical Chemist, Leamington.*

Let the soil be well dried in a warm place for four or five days, sift it through a coarse sieve, and weigh out 500 grains, which is the most convenient quantity to examine, taking care that all results are divided by five to reduce it to the per centage. Heat these 500 grains from about 240° to 230° for half an hour in an oil-bath, stirring occasionally; weigh: the loss is moisture. Heat the remainder to low redness in a crucible for about half an hour, so as to burn it well; weigh when cold: the loss is organic matter. Boil in a large flask for eight hours with 8 oz. of pure muriatic acid and 2 oz. of water, constantly adding when boiled away till about 6 oz. are left: filter while hot on a weighed filter; wash well with distilled water until the washings cease to be acid and dry; ignite and weigh the residue, which is almost pure silica, or sand, with silicate of alumina.

The solution contains oxide of iron, manganese, alumina, lime, phosphoric acid, magnesia, &c.

Saturate this solution with ammonia, which precipitates alumina, oxide of iron, and phosphate of lime; keep the bottle stopped to prevent the conversion of lime into carbonate; pour off clear, and add distilled water; shake up well, keeping the bottle well stopped, and again pour off, and wash again; filter on a weighed filter covered over, and wash well; add all the washings to the solution, and dry to about the firmness of butter; remove with a spatula, and digest with heat in solution of potash for an hour: this dissolves the alumina, leaving the phosphate of lime and oxide of iron; filter while hot on the same filter which retains the phosphate of lime and oxide of iron; wash well, and add the washings to the solution of alumina in potash; saturate this with muriatic acid to redissolve the alumina at first precipitated; then add excess of ammonia: this precipitates the whole of the alumina, which filter, wash, dry, ignite, and weigh.

The oxide of iron and phosphate of lime on the filter can either be well dried and weighed in conjunction, or separated with alcohol; diluted with two parts water, and acidulated with forty drops of sulphuric acid to the ounce; this must be poured warm into the filter and back again two or three times: it dissolves the oxide of iron, and leaves sulphate of lime, into which it has converted the phosphate; dry this, ignite, and weigh: five parts correspond to four of the phosphate.

The iron in solution in the alcohol can be precipitated with ammonia; filter it, wash well, ignite, and weigh.

The solution still contains the manganese, if present, and the lime, which existed in the soil as carbonate, and the magnesia. To separate lime, add solution of oxalate of ammonia (taking care that the liquid is alkaline, as oxalate of lime is soluble in acids), boil for a few minutes, and set aside in a warm place for four or six hours; filter, wash, dry, ignite, and weigh: pure carbonate of lime remains. The magnesia is separated by adding a solution of caustic soda, washing, drying, igniting, and weighing: pure magnesia remains. The manganese is to be precipitated by adding a solution of hydro-sulphate of ammonia, which gives a flesh-colored precipitate; dark brown, if iron is present in conjunction; well wash the precipitate, and pass muriatic acid through, and add carbonate of potash to the solution; filter, dry, ignite, and weigh. 100 grains = 93 of protoxide of manganese.

For determining the amount of sulphate of lime which may yet exist, boil three hundred grains of the soil with one pint of water, with about 80 or 90 grains of sal ammoniac; filter, and evaporate down to 2 oz., and add 1 oz. of alcohol; the sulphate of lime directly falls, and may be collected on a filter, dried, and weighed.

To determine the quantity of chlorides of potash and soda, boil 300 grains with 10 oz. of water for two hours: filter and wash well, and precipitate the chlorine with nitrate of silver; wash, dry, ignite, and weigh. 50 grains are equal to 22 of the mixed chlorides of potash and soda. Farm. Mag.

American Telescopes.

The recent erection of numerous Observatories in this country, furnished with instruments of the largest class, is a subject of congratulation with every friend of astronomy. The Observatory at Cambridge has been provided with a refracting telescope of *twenty-three* feet focal length, and fifteen inches aperture, at a cost of eighteen thousand dollars, exclusive of the duties which amount to thirty per cent. This instrument is of the same dimensions as that of Pulkova, which hitherto was the largest refracting telescope ever manufactured. The Observatory at Cincinnati is provided with a telescope of *eighteen* feet focal length and *twelve* inches aperture, at a cost of about ten thousand dollars. The Observatory at Washington has a telescope of *fourteen* feet focal length, and *nine* inches aperture, which cost six thousand dollars; and the Observatory at Philadelphia has a telescope *eight* feet focal length and *six* inches aperture, which cost two thousand dollars. All these telescopes were from the establishment of Merz & Mahler, successors to the celebrated Fraunhofer, at Munich in Germany.

The question is almost daily asked, why do you not patronise American artists? Can we not make good telescopes in this country? To this question, the answer has uniformly been in the negative. Some very good reflecting telescopes have been made by Mr. Holcombe, of Southwick, Massachusetts, and by several amateur astronomers. But although these telescopes afford a good light, and perform remarkably well on double stars and on nebulæ, still the style of mounting is very rude. They are not furnished with graduated circles for measuring the place of a heavenly body, and such appendages are considered almost indispensable in a regular Observatory. Moreover the mirrors are liable to tarnish from exposure to the air, so that the preference is now generally given to refracting telescopes.

The experiments which have been made in this country in the manufacture of refracting telescopes may be divided into two classes: namely, those which have employed American glass, and those which have employed foreign glass.

Several telescopes of small dimensions have been made of American glass, which have performed quite satisfactorily; but the attempts to make large telescopes with American glass, so far as the results have been laid before the public, have invariably proved failures. At several establishments in this country, glass is manufactured which answers perfectly all the ordinary purposes of the arts, and for transparency compares well with foreign glass: but it has been found impossible to obtain large specimens possessing that entire homogeneity and freedom from veins which are demanded in a lens in order that it may produce a perfect image. Hence, notwithstanding some high pretensions to the contrary, no *good* telescope of large dimensions has yet been manufactured of American glass. The Munich telescopes are all made of glass manufactured under the direction of Merz & Mahler themselves, by peculiar methods which are carefully concealed from the public, and which are the results of the experiments of Guinand and Fraunhofer.

The experiments which have been made in this country in the manufacture of refracting telescopes with the aid of foreign glass, have been more successful. Passing by several very good instruments of small dimensions, it is believed that the telescopes executed by Mr. Henry Fitz of this city are the most remarkable of any hitherto made in America, for their size and quality. Mr. Fitz has completed three telescopes of *five* feet focal length, one of *seven* and one of *eight* feet. Two of these I have had an opportunity carefully to examine. One is a telescope of *five* feet focal length, and *four* inches aperture, now in the possession of Lewis M. Rutherford, Esq.; the other is of *eight* feet focal length, and *six* inches aperture. These are both achromatic: that is, each of them consists of two lenses, one of flint and the other of crown glass. The flint lens is made of glass imported to order from Paris; the crown lens is of French plate glass. The five feet telescope is mounted upon a substantial equatorial stand, under a revolving dome, which affords every facility for directing the tube towards any part of the heavens. Having turned the instrument towards Saturn, the planet appeared of a beautiful white light without any sensible prismatic dispersion, and with a perfectly sharp outline. The shadow of the ring cast upon the body of the planet, and the shadow of the planet cast upon the ring, were both beautifully seen, and also the belted appearance of the planet. It showed distinctly *five satellites.* The planet Neptune was seen without any appreciable disk; but its light was such that it was distinctly visible in a brightly illumined field. The planet Mars was seen perfectly round and sharp, with an irregular stripe of a dark shade across the middle of the disk. Very faint stars are exhibited in this telescope with remarkable distinctness. The small star "debilissima" near Epsilon Lyrae, which is considered a good test object for a seven feet achromatic, can be seen in it with comparative ease; and the companion of the Pole star is visible in an illumined field.

The trial of the other object glass of eight feet focus was made under more unfavorable circumstances, as the telescope is not yet entirely completed. The glass is finished, and it is set in a neat mahogany tube; but it has no permanent stand, nor appropriate set of eye-pieces. We were obliged to mount it upon a tremulous stand, in the open air; make use of an eye-piece which belonged to the smaller telescope; and follow an object in its diurnal course by moving the tube with the hand. Under all these disadvantages the telescope performed admirably. It showed the disk of Saturn sharp and distinct, and of a beautiful white light. The shadow of the ring upon the planet, and of the planet upon the ring were easily seen, and there was scarce a trace of uncorrected color to be ascribed to the lenses.

On the whole, Mr. Fitz has succeeded admirably in grinding lenses of the proper figure. He has executed several object glasses which are almost entirely free from chromatic and spherical aberration—and which, when tried upon the most difficult test objects, compare well with the best productions of Fraunhofer. It is to be hoped that Mr. Fitz may receive that encouragement in the manufacture of telescopes, which his ingenuity and perseverance so richly deserve.

Elias Loomis.

New York University, Nov. 12, 1847.

N. Y. Cour. & Enq.

Mammoth Starch Factory in Michigan.

We learn from the "*Detroit Free Press,*" that Mr. Mawbry Chamberlain, of Vermont, removed to Almont, Lapear County, Michigan, about two years since. Mr. C. carried on the business extensively in Vermont, and is still interested in two large establishments, managed by his brothers, near Windsor, Vt. It seems that he has now erected a factory in Almont, to carry on the manufacture of starch on a more extensive scale than at any similar factory at the East.

The factory is 214 feet long, and 40 feet wide, including an L. The main building is 134 feet long—14 of which are used for an engine room—and is two stories high. The lower part has 64 tubs, holding about 600 gallons each, giving a total of 28,400 gallons. The L part is 80 feet long, by 40, of brick, one and a half stories high, for a potato-bin. Loaded teams drive up a platform into the second story; and, following a circle, 13 teams can unload at a time, through trap doors over the bin, which is calculated to hold 40,000 bushels. One hundred and thirty loads have been received in a day, making a total of 4000 bushels.

In the second story of the principal building is an oven, 100 feet long by 18 wide, for drying the starch—or rather, I should say, an oven of 200 feet by 9, as there is a division in the centre, with doors some 10 feet apart. In the oven, there are sets of pans, one above the other, which can be turned at pleasure. It is heated from the steam works, and conductors of heat are carried in tin pipes all over the building. The whole machinery is a specimen of so much ingenuity, that I cannot describe it. You must visit it—it is worth the journey. The proprietor, who is a gentleman much beloved here, kindly allows strangers to go through the establishment, and does not confine it to the sign, "no admittance," as at similar works in New England.

The potatoes are shoveled from a bin into a hopper, where there is water constantly running into it, and there they are as thoroughly washed by machinery, as a cook could do it for your dinner. Then, by the action of machinery, they are separated from the dirt, stones, and sticks, and pass on to two cylinder graters, at the rate of 100 bushels an hour. From the graters, by the action of machinery, they go into the sieve that separates the starch from the potato. The pulp then passes into four large cisterns, and then, again, machinery pumps it into the 64 large tubs or cisterns, before alluded to, for settling. Then the water is drawn off, and the starch, by a forcing-pump, is carried into the second story, and, when settled, put into the oven I have before spoken of, which is calculated to bake a day's work – being the starch from 1000 bushels, or 60,000 lbs. of potatoes. The starch is packed in casks, and shipped East. The cost of the factory is $12,000.

Considerable starch was made last season, but the rotting of some 30,000 bushels of potatoes last fall, curtailed the quantity anticipated. This large quantity of the raw material was thrown away. It served to feed many cattle and hogs of the neighborhood for some months.

The pulp remaining as worthless, is used in fattening hogs, which the proprietor has in a yard adjoining.

The factory price for potatoes is 10 cents a bushel. Mr C. has contracted with various farmers to the amount of 400 acres. The average number of bushels raised last year on an acre was 275. Allowing the same this year, it will amount to over 100,000 bushels; but this is not half the quantity wanted. Farmers were unwilling to contract, fearing the rot. Present indications are good for the crop. All varieties are used, even the Rohan.

It takes the fall and winter to destroy the potatoes, then wheat and corn are used for the same purpose. The quantity made from the potato per year will not be far from 1,000,000 lbs., or 400 tons. It sells for $5 a hundred in New York. Hunt's Merch. Mag.

Fusion of Mercury.

The result of M. Person's experiments on the congelation of mercury, and the latent heat of fusion, is that the heat requisite for the fusion of mercury is about eight times that required to change the temperature of water one degree. M. Person observes that the quantity of heat necessary for the fusion of metals is according to the order of their tenacity. Civ. Eng. & Arch. Jour.

Steam Power in France.

It appears from a recent official return that the total number of steam engines in France in 1845 was 207; in 1840, it was only 109. Another return respecting the produce of the iron mines states that in 1845 the quantity of iron cast was 439,000 tons, whereas in 1825 the quantity was only 190,000. The price of bar iron, which in 1825 was 48f. the 100 kilogrammes, was in 1845 only 34f. Ib.

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